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THE PREVENTION OF LOSS BY

AND THE SYSTEM OF

FACTORY MUTUAL INSUI

AN ADDRESS BY

EDWARD ATKINSO

ASTOR LIBRARY NY

OF BOSTON,

President of the Boston Manufacturers Mutual Fi
Company, given in

MINNEAPOLIS, MINNESO

189.

AT THE REQUEST OF

THE WESTERN MANUFACTURERS MUTUAL INSURANCE CO., CH
THE MILLERS' AND MANUFACTURERS MUTUAL INSURANCE CO., MIN
THE CENTRAL MANUFACTURERS MUTUAL INSURANCE CO., VAN
THE MANUFACTURERS AND MERCHANTS MUTUAL INSURANCE CO.,

SEPTEMBER 17, 1885.

CHICAGO:
JOHN MORRIS COMPANY, PRINTERS
1885.

NEW YORK
PUBLIC
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Gentlemen: I have been requested by my friends who manage the Mutual Insura Chicago and Minneapolis, in which your mills and works are in part insured, to wait return from the far Northwest, in order to inform you as to what we have accomplished in ing not only indemnity for the small losses which must be incurred in cotton, woolen cordage and jute factories, print works and bleacheries, machine shops, metal works a also to instruct you, if I may use the term, in the method by means of which we h greater losses to which all other branches of industry are subjected. I only received t way out to the Yellowstone Park a few days since, and I have been obliged to put this on the cars on my way back, leaving blanks for the figures, which I have put in fro sent here to meet me. You must not, therefore, expect very much in the matter of fo can give you the substance of what you want to know.

Many of you are probably prejudiced against what is commonly known as Mutual if you insure your property at all, you are engaged in a system of Mutual Insurance w it or not—all insurance is mutual. Your own premiums which you pay to an insu whether it be known as a stock company, or a mutual company, constitute the only f your own losses are to be paid, if the insurance company in which you are insured is any stability. The moment you touch the capital of a stock company for the payme that moment the company becomes unsafe to contract with, and may become bankrupt tal is made up by contributions of new capital and higher or new premiums on new r fore, follows that the capital of a stock company serves only as a sort of guaranty t issued by it will be paid in case of loss; just as the liability to assessment serves as suc the mutual company.

But there are other and essential differences in the matter, to which I may as wel without further reference to what may be called the general principles of insurance. by asking a few simple but searching questions.

First. Do you wish to put up your money on a bet that bad risks will not burn? continue to pay premiums for contracts of indemnity under the name of policies of i you now do, and you will have no interest in this address.

Second. Do you desire only to haggle about rate of premium for insurance? If s you are—look upon your underwriter as an obnoxious person whom you would bull and whom you regard as a nuisance when he visits you. In such case I have no furt addressing you.

Third. Do you expect to secure contracts of indemnity against useless loss at les so, go on just as you are, and wake up by-and-by when a great conflagration strikes great cities to find most of your policies worth 50 cents on a dollar, or less. It v fault, and you will have secured just what you have paid for.

Fourth. But if you wish to prevent loss by fire, then combine for your own pr else can protect you. You have only two alternatives. You can waste your money o with the odds against you as you now do, or spend your money in a judicious way for

tection. In other words, you may combine your premiums in stock insurance companies at an average cost of 35% to 40% of the premiums, and take your chances on bad construction, inadequate protection, and careless occupation; or else you may combine your premiums in a mutual system at a cost of only 5% to 10% of the premiums, and spend what you save for one or two years in right methods of preventing loss. After the first cost of protecting yourselves has been recovered, you may credit to your own indemnity fund such a profit that in seven to ten years the interest on this fund will serve to cover the cost of insuring your property for all time to come.

I have been a Director in the Boston Manufacturers Mutual Fire Insurance Company for many years, and President for eight years. We have about $75,000,000 at risk. Had the dividends which have been made to the members in the last eight years been accumulated at 5%, and were this sum now invested at 5%, the income would suffice to cover the probable cost of carrying all our policies for all time to come. In other words, the saving upon an average rate of 85 cents on each $100 insured thus accumulated for eight years, would perpetually insure the property.

Note, page 21, appendix.

How much can you save on a rate of $4 to $5 on each $100 insured on risks which, when properly protected, may be in my judgment covered at a cost of less than 1%? Our members have accumulated only two thirds of 1% in their indemnity fund. You can lay by 3% or 4% a year if you choose.

In my judgment a flour mill may be made as safe as a cotton mill, a woolen mill, or a paper mill. The only difference is that the first cost of the apparatus will be a little more, because of the necessary open ways from one floor to all others.

You are broad gauge men out here. Your ideas and your transactions are in some ways commensurate with the breadth of your own prairies, but not in all. I am told that you actually pay from 4% to 6% premiums on your big flour mills. In this matter of insurance you remind me of a story.

Did you ever hear of the man who bought a horse for ordinary family use, and paid $2,000 for him. When he got him home, he asked his black groom what he thought of his purchase. "Well," said the darkey, "it 'minds me of a proverb; I'se forgot the fuss part, but de lass part is, 'and his money is soon parted.'" The man who continues to pay such a price as you now do for a contract of indemnity against loss, instead of insuring himself by adopting suitable methods of preventing fire, will soon bear witness to the truth of the darkey's proverb. The present close methods of business which have become necessary even here, will no longer bear such a useless charge; and yet, let me tell you the present charge for stock insurance is not high enough on the average. Almost every man thinks the premium which he pays is too high, but the general average is not high enough.

I will incorporate an analysis in proof of this, which I submitted to the merchants of Boston less than a year since; since which date they have adopted the mutual plan, and are now organizing a company for the insurance of their own risks, with a guaranty fund which is to be replaced by scrip as the profit or saving of the business accumulates.

In 1884, all the Insurance Companies reporting to the Insurance Commissioner of New York, received fire premiums amounting to $78,000,000, on risks in this country. (It may be assumed that the total premium paid in the United States is about $100,000,000 a year, as there are many Insurance Companies which transact no business in the State of New York, although they take risks in that State. Such Companies make no return to the New York Commissioner of Insurance.)

Their losses in round figures were $50,000,000, or 64%; their expenses $28,500,000, or 37%; making 101%. Their capital was therefore impaired $500,000; and since then the rates have been advanced as they needed to be in order that the system might continue to exist.

The inherent risk of the property covered by the Factory Mutuals is doubtless greater than the average risk of that covered by the stock companies. Were it possible to apply the system of preventing loss, $78,000,000 paid in premiums would yield an average result on our standard, as follows:

Losses, expenses and taxes, all told, - - -	$25,000,000
Returned to the assured, or set aside for their future benefit, -	53,000,000

Which statement do you like best? It all rests with yourselves which you will choose.

But while the average rate is not high enough, you may yet complain that you c consideration from stock companies when you put in apparatus and attempt to prote it was when Zachariah Allen, of Providence, just fifty years ago, fitted the Allendal the best apparatus then known, and asked an abatement of the rate then charged. "T "a cotton mill is a cotton mill; the rate is 2½%." "Then," said Mr. Allen, "the c mills will insure themselves." He at once organized the Manufacturers' Mutual Fi pany of Providence, on which all our Factory Mutuals are modeled.

You will understand that this system of making the prevention of loss by fire the underwriter and the payment of a loss an obnoxious incident which is somebody's thing. It is fifty years old, and the credit of it belongs to Rhode Island and not to I am a mere representative of a system built up by my predecessors, and some of my cc mutual companies have had longer experience than I myself have had. We work tc monthly conferences, and to each man the system is everything, the specific company ate part.

The rate of premium on the Allendale Cotton Mill is now eight-tenths of one of two and a half per cent, and of the annual charge of 8-10ths, two-thirds to three-qu year by year, while the stock companies of fifty years since who refused all concession rupt. The sum of money which that corporation has received back from the Mutual their organization, had it been laid aside at simple interest, would be more than the the entire property. The Mutual Combination which Mr. Allen founded now covers nea worth of factory risks.

On the first of August, 1885, 1,279 policies expired in all the Factory Mutuals, covering the sum of - -	$26,059,(
The premium which had been deposited on these policies twelve months before amounted to - - -	229,1
The share of the losses and expenses in the twelve months which was charged to these policies was - -	40,9
The dividend to the holders of these policies, returned to them on their expiration was - - - -	188,2

Leaving the cost of their insurance for the twelve months 15 7-10 cents on each $ than one-sixth of one per cent.

Had this $229,175 been paid to stock companies for similar policies, the proport have been set aside for the mere cost of conducting their business, would have been (expenses only, or double the losses, expenses and taxes combined in the Mutual Compa

The interest on our premiums nearly pays all our expenses, including taxes.

What will you do about it? On every thousand dollars of premium which you nc of $350 to $400 is absorbed by the expenses, and only $600 to $650 serves for your i You pay more than $1 of expense to get $2 worth of uncertain indemnity.

In every thousand dollars paid to us, less than $40 goes to expenses and taxes, wl into the indemnity fund; this fund has proved to be three times as much as is necess

Does that interest you? If it does you can obtain the same security, the same inc same profit, if you will only learn the open secret. What is the secret? *Protect you* else can protect you.

Now I may assume that you are ripe for instruction. In most cases, if I were trea risk, such as the ordinary stone church, brick hospital, asylum, or almshouse, or the should say that the first lesson is, *that everything that is is wrong.* There are of course ous exceptions, even in the class of risks which I have named; and one of the most cor most excellent "West's Hotel." I may also except the two great flour mills which I h this city. I find in them but a few of the common faults, and if your flour mills as judged by them, the way is plain for you to protect yourselves on the mutual princip expenditure for apparatus beyond a single year's premium now paid for partial in

companies. After such expenditure on a sufficient number of risks of an analogous kind, I do not think the cost of your insurance would exceed one per cent. I make this statement with some reservation because my knowledge of the risk is inadequate; but I am of opinion that since you have removed the dust from the body of the mill, you are not as subject to as rapid spread of fire outside the elevators and bolting chests as we are in the picker, card and mule rooms of a cotton factory; and I can see no greater difficulty in protecting the elevators and bolting chests than we meet in the dangerous departments of our factories; but it will cost you rather more to do so because the work would be more complex.

I have referred to the ordinary modes of constructing churches as bad—we burn $1\frac{1}{4}$ to $1\frac{1}{2}$ churches every week.

I mentioned the common ruck of hotels as dangerous—we burn one hotel and a quarter every day.

I named hospitals, asylums and almshouses—we burn one every two weeks, usually with a considerable loss of life.

We destroy $100,000,000 worth of property by fire every year; or nearly $1 in a $100 of all that we produce; and yet we call ourselves an intelligent people. We spend in addition at least $35,000,000 annually in sustaining an ineffectual system of insurance, and at least $25,000,000 on fire departments. Our whole fire tax is $150,000,000 to $160,000,000 a year, or ten to fifteen per cent. of our possible savings in a prosperous year. One half this sum is the price which we pay for stupidity, ignorance, carelessness and crime. If you were about to build an hospital or asylum for your city, the chances are that you would be imposed upon by a pretty picture called an architect's design or plan, to be composed of an outer shell or sham of brick, stone or iron, inside of which you would put a cellular structure of wood cut in such a way as to insure the most rapid combustion, and put together in such a manner that the fire would pass all over the building, most fully protected from water. On this you would spend twice or three times as much money as would suffice to build a building of solid timber, plank and brick, put together in such a way that there need be not a single cavity or hollow space in wall, floor, partition, or roof, in which a mouse could build a nest. Possibly you might be as wise as the authorities of Indiana, who have adopted our methods of construction in some large hospitals for the insane.

But my function is to deal with the simpler problem of building and protecting a factory, a flour mill, or a woodworking establishment.

Now that the use of steam is displacing water for power, and a choice of location can be made, we advise one or two story factories in place of higher buildings; but this plan you cannot adopt in respect to flour mills. The one story mill can be built at as low a cost per square foot of floor, as the four or five story mill. The two story mill can be built at a lower cost per foot of floor.

Notes and cuts, pages 22 to 33 inclusive, appendix.

If suitable attention be given to the thickness of the roof and the monitor or lantern with vertical windows be placed overhead in place of the ordinary slanting skylights, the one-story factory will be as cool in summer, as warm in winter, and can be much better ventilated than any higher building. In some cases where the work is dark and a great deal of artificial light is needed, the saving in gas has paid the interest on the cost of a one-story factory. A considerable economy of labor has also proved to be possible, especially in respect to overseers and second hands, when the machinery is all upon one or two floors.

I now beg to submit to you the plan of construction, either of a one or five-story factory. The timbers are 10″x12″, or 12″x14″ or 16″, 8 feet, 9 feet or 10 feet 4 inches on centers. They may be solid or in two parts bolted together, not exceeding 25 feet span. The floor plank are laid flat on these timbers, grooved and splined—3 inches thick on the narrower bays; 4 inches thick on the wide bay. Over this a top floor is laid 1 inch thick, but the work will be better and safer if mortar or asbestos paper is placed between the plank and the top floor. No sheathing is permitted upon the under side of the timbers so as to make a hollow floor, but when sheathing is required it is nailed solid to the under

side of the plank, between the timbers. In dangerous departments plastering is lai following the line of plank and timbers. Square posts untapered are stronger than r

In the East we now use mostly Southern pine timber, and maple or birch for to

The roofs are of the same construction with a slight pitch, and had better be ma inches thick, over which may be placed composition roofing, tin, or cotton duck pa subject of covering flat roofs is treated in one of these special reports.

Note "A," pages 34, 35 *and* 36, *appendix.*

In all the more recent mills the main belts are carried up in a separate belt tov which the shafts are carried. The stairways are customarily in a brick tower, in whi and hydrants are also placed. Outside stand-pipes which can only be worked from are not of much use. Stand-pipes are carried out from the porch upon the roo thereon. Exposed windows and doorways are protected with wooden doors of two t inch pine or oak nailed together and fully encased in tin. The main point is that t twist or crack under heat. Either wood is strong enough.

The theory is this: the wood being completely encased in tin well locked, the su bonized; then the oxygen is exhausted and combustion ceases or proceeds slowly, whi charcoal being an excellent non-conductor of heat, keeps the heart of the wood cool, s The Providence Steam & Gas Pipe Company furnish an automatic appliance by whic becomes automatic and will close itself. It would be easy to rig shutters to windows to dangerous buildings, so that the heat of a fire sixty feet off would cause them to cl

Note "B" and cuts, pages 37 *to* 41 *inclusive, appendix.*

Iron doors are a snare and delusion; iron shutters worse. They neither keep t but they exclude both firemen and water. Iron roofs are almost unfit to be considered

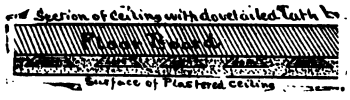
You will observe that no concealed or cased in space is permitted in floor, parti that the open timber construction gives a free play for water to sweep away a fire betw while in the common floor made of plank set 18″ to 2 feet on centers, fire will hang on floor joist, while the water is playing on the other.

All the details of construction of doors, windows and other parts of the mill, will plans submitted herewith. The boiler houses should be separate, as should be the other dangerous departments. Drying rooms require especial attention, and are now fire-proof. The present cost of a one, three, four or five-story factory above the fo about 80 cents per square foot of floor. The two-story mill about 10 per cent less. T the one-story mill may be very light, provided the piers are frequent. Plans are given for solid floors of concrete covered with boards, laid in such a way as to be durable. crete or artificial stone is apt to yield dust injurious to fine machinery.

There is such a thing as a building made of incombustible material, but they There is no such thing as a fire-proof building, if you charge it with sufficient comb We do not insure wheat elevators, but when a "fire-proof" elevator in Philadelphia, o 600,000 bushels, was totally destroyed by fire, one of our men was appointed adjuster, partial person. We found that 60,000 bushels in the elevator had been ignited for wa door between the boiler house and the elevator; and the destruction from the heat was the 600 tons of old iron left in the wreck of the main building did not pay for the removal. People sometimes build fire-proof warehouses for cotton and succeed in m which the cotton is totally consumed. I prefer to insure cotton in a pile, shingled ov on the sides, and with weather boards on top.

Our mode of construction, which we call *slow burning*, rather than fire-proof, is no in many other buildings, besides factories. Many large warehouses, the Medical Sch Laboratory of the Institute of Technology, and others in Boston; the Fishery Buildi Bay, the new Science Building at Amherst; a Commercial Block covering a whole sq

l the new Insane Hospitals in Indiana, are being, or have been constructed in this way. Dwelling ıses will soon be built whenever we find a way to stop the passage of sound through the solid floors, a moderate cost. It can now be done at some extra expense. In my judgment the solid plank roof, ›oved and splined, should be put on every building, whether flat or pitched. It is dry and imperv- ıs to heat and cold. Witness your elevator buildings. On a pitched roof all shingles should be d over mortar. Then sheathe solid on the inside of the roof boards, between the rafters set five feet ırt, and your roof will cease to be a sham, as it now is. If plastering is desired, it may be laid solid ;ween the roof timbers by using dove-tailed laths.



I observe that a master of what I have dared to call the crazy roof style of architecture, has ;ched this neighborhood. I cannot abide these roofs of the sharp pitch and deep valley style, orna- nted with inverted mustard and pepper pots, varied with ornaments or decoration apparently copied m ice cream molds.

I observed such a roof in progress in the suburbs--bad boards laid open on flimsy rafters to be plastered. ıide. Just where you want the most solid substance to keep the heat of the summer sun out, and › warmth of the winter's fuel in, you create an oven in summer, and a refrigerator in winter. Thus spoil our attics which might be the best part of our houses. I did it myself before I became Presi- nt of an Insurance Company and an anti-combustion missionary, so I have a right to grumble. I nost wish it would combust some time when the family is away. I must refer you to these plans for › details of factory roofs and all other matters, but I may call your attention to the plan of the window the one-story mill design. The two lower lights being fixed vertically, and the upper light opening ıvardly on hinges. In this climate the windows should be double glazed. The kind of window scribed is much better and cheaper than the window fitted with movable sash hung with weights. ıe windows in the monitors should always be double, or double glazed, in order to avoid the conden- ;ion of moisture on the inside, which drips on the machinery. I understand that you are troubled th condensation on the underside of your roofs. This is because the material is too thin. If you ll make a solid deck of three inch plank, you will have no trouble from condensation. Sloping sky- ;hts through which the rays of the sun pass directly are very hot. The vertical windows of the moni- ' are not subject to this objection; they reflect the heat. There are many other matters of detail, ıich are fully treated in the documents which are in Mr. Montgomery's possession in Chicago and ıich I shall leave with Mr. Shove; or you will find them in the little book by one of our inspectors, '. C. J. H. Woodbury, entitled "Fire Protection of Mills," published by John Wiley & Sons, of ›w York.

But, you will say, our mills and works are built; how can we avail ourselves of these methods? ›u may not to the full extent; but, if your walls or ceilings are sheathed, or if your roofs are hollow, u can strip them. It is more important to avoid the vertical cells inside the sheathing on the walls, ıich may carry fire from one floor to another, than it is to remove sheathing from ceilings; but hollow ›fs are most treacherous. It is always suitable to strip the sheathing from the roof, and to fasten › same material solid on the inside of the roof boards, between the rafters. Such a roof is a better n-conductor than any air-spaced roof.

I will now interpolate an example of such changes which I related yesterday to one of your num- r and it is at his suggestion that I put it in.

A few years since the owners of a jute factory in Paterson, N. J., applied to us for insurance. ıe building was of stone, walls bare, but floors and roof beautifully sheathed on the underside. Sixty ›t away was a flax factory, and sixty feet further a locomotive works. The latter had applied to us, t thought our conditions unreasonable. They knew their risk was good and could not burn; we did t concur and declined to insure them. We told the jute people that if they would put in a large steam

pump, take off the sheathing, and convert it into shutters covered with tin, to protect th the adjacent risks, we would take them. They objected to the removal of the sheatl tight, and there could be no lint behind it. We declined to take the risk with the sl suggested the removal of a single board in order that they might confirm their own their utter astonishment the interspace was packed with lint, of which several tons wer the sheathing then came down. The rest of our advice was at once taken, without i and we wrote policies which cost them $500 net, for full insurance in the ensuing yea paid for partial insurance, the year before. In this first year, the locomotive works, burn, took fire, warped all the iron shutters, and let the fire over, under a gale of wir factory, which went down in a few minutes, and then the two fires attacked our risk, un blowing directly on the factory. The shutters stood; the steam-pump did its work; the was requested to save the adjacent property and not to bother about the factory; in th few dollars for paint and water, none for fire damage. The locomotive building, rebu with our rules, is now insured by us; both it and the jute mill now enjoying the ad tion of automatic sprinklers, which have been introduced since these incidents occurred.

We may now assume that the mill or works is in a suitable condition to be insure means of protection are adequate. What appliances are necessary?

We will first consider the apparatus in chief. We always call for two sources of w possible; at any rate two independent pumps, preferably one rotary pump operated by v with a friction gear so that it can be put in operation without checking the speed of other a steam pump. The Holyoke Machine Company, of Holyoke, Mass., and the Fale Co., of Pawtucket, R. I., make these rotary pumps and friction gears.

Connected with these should be an adequate service of pipes, hydrants and sta employ inspectors who are fully competent to plan this service, which is usually ina when put in under our direction; both in the capacity of the pumps and in the sizes a of the service pipes. All pumps are subject to being tried at least once a year by and oftener if any defect is suspected. In many places where the substantial danger is machinery is in operation and the workmen are present, we advise small hose to be quent intervals to the main water-pipe in each room.

The apparatus in chief being thus established with a view to the control of a fire v obtained a considerable headway, we may next consider the auxiliary apparatus.

More fires are put out with buckets of water than by all other appliances. Our advi many buckets of water as you think can be used; then put in as many pails and keep i some more buckets, and then some more pails, until you are sure you have enough.

Chemical engines are sometimes added. Fire extinguishers are occasionally usefu ades and all such rubbish, we object to, lest in the attempt to use them valuable time When the pails fail, it is time for the pumps, if the automatics are not at work. Elect are useful in the absence of automatic sprinklers. (*Note page* 42, *appendix.*) The au ler is a device by which the fire lets on the water, puts itself out, and at the same time alarm and tells where it is. It is both a fire alarm and a fire extinguisher.

Watchmen and a first rate watch clock are absolutely required. Lastly, automatic lately been introduced in all departments in which the stock is worked in a loose or di tion; it is only a question of time when they will be placed everywhere. We do no substitution of automatic sprinklers, where a service of perforated pipes had been plac our members have made the change voluntarily, in order to diminish their liability to

While we do not give way in the least measure in our requirement for adequate hydrants, and apparatus in chief, we yet consider the automatic sprinkler the most val appliance, the best fire detector, the watchman who never sleeps, and the device which i be out of order when needed. Our members have expended at least $1,000,000 on the a the last five years, and I am confident that they have already saved at least $1,500,000; we cannot prove this. The latest computation of results is as follows:

Note "A," pages 43, 44 and cut, page 45, appendix.

There are more than one of these sprinklers which we accept as an adequate protection against fire, as well as many that we will not accept. We put the responsibility of selection on our members as to all other risks than that of fire. The risk of leakage is small or almost nothing, especially in the Grinnell Sprinkler because the pressure of the water itself keeps the joint tight. Of course, care must be taken to avoid freezing. It is better that the water should be on the sprinklers, but there are dry pipe systems which we accept, and also air pressure systems where there is not a sufficient water pressure, also systems for starting the steam fire pump automatically. I can see no difficulty in adapting this system of sprinklers to your flour mills. If you are afraid of leakage and damage to the bolting chests, if the sprinklerheads are put inside, I see no reason why they cannot be placed outside against a plate of thin glass, which will be quickly broken by heat, but will keep the water out if the sprinkler leaks or is broken. In this way we have advised the protection of main belts.

Note "B," page 46, appendix.

You will observe that the more removed your existing mills are from the safe methods of construction which I have presented, or the more sheathing you have which cannot be removed—then the greater the expediency for you to adopt some kind of automatic sprinkler; because, when it works, it will hold or extinguish the fire so quickly that even thin sheathing will not be burned through, and the fire will have no chance to get into the interspaces of the walls, or into the hollow floors. These sprinklers have never yet failed to put out, or to hold a fire in sufficient check for easy extinguishment, where they have been in place at the point where the fire began.

The danger of leakage in the automatic system is a bugbear, so far as the sprinklers are concerned which are properly constructed. We have about one new head submitted to us every week; each a modification of the other, and almost all subject to the pressure of the water in the direction of the opening of the valve. You will observe, however, that sprinklers can be made in which the pressure of the water keeps the joint tight; and the greater the pressure the less the danger of leakage. Mr. Grinnell, who is present, will explain this; that is his business, not mine. I have no personal interest in sprinklers. If I ever invent a good one, which I hope to do, I shall give it away or resign my present office. No underwriter can have any interest in a fire appliance.

I lately sent out an inquiry to our principal members on leakage. The experience of those who replied, covers about five years, and perhaps 200,000 sprinklerheads, more or less, of all the kinds which we have accepted.

Number of reports received,	224	
Number of cases of leakage where no accident occurred,		22
No damage,	16	
Slight damage,	6	
Total,	22	
Number of accidents causing leakage,		41
No damage,	27	
Small damage,	14	
Total,	41	

This covers the whole history of all the sprinklers, even before the best were perfected.

The elevator heads in your flour mills can be easily protected with automatic sprinklers, but there is a great fault in the construction of these heads. There should be no horizontal surface inside the elevator head on which the dust can collect.

You cannot remove your driving belts from mills now built; but the orifices in the floors can be easily guarded, in the manner previously described.

All open stairways should be closed, and all the common lifting elevator shafts sh with automatic hatchways. The Cohoes Iron Foundry, Cohoes, N. Y., makes several be fitted to any shaft.

Lanterns were formerly a cause of great loss, because of their bad construction. Sons, of Boston, now make the best; and I have reason to hope they have just now inv lantern which we can accept. All the existing kerosene lanterns which I have seen, w owing to their very flimsy construction.

The best and cheapest hose for inside use is plain linen hose, provided it is of t such as is made by Ross, Turner & Co., of Boston. Poor linen hose is mere rubbish.

The best hose for outside use is cotton, rubber-lined. Linen is quickly destroyed i ber, by the sulphur.

The greater part of our risks are lighted by gas which has been made from coal o retort. The more conservative Mutual Companies will not insure a factory which is l vapor of gasoline, by means of what are called gas machines. It is a mere vapor of a than the atmosphere, and is a cause of dangerous explosion. If I were called upon to a barrel of gunpowder in my cellar, or the risk of gasoline vapor from a gas machine, l pipes and accumulating in the cellar, I would choose the visible explosive, and keep out of the house.

For lighting, the incandescent electric system is to be preferred where it will serve about 150 risks in which kerosene lamps are used. We advise as to the kind of lamp a the oil, and have never had any serious loss from a fixed kerosene lamp. (Note page 56

The common ruck of unprotected glass lamps for kerosene oil are utterly unfit for u

We accept the Westland Safety Lamp, of Providence, which consists of two globes water between highly charged with carbonic acid gas, so that the lamp itself is a fire e the Bradley Lamp, made by the Union Glass Co., Boston, which consists of a very h protected with a tin case, or a similar lamp made by F. O. Dewey & Son, Boston.

Pure mineral oil is preferred for lubrication, because it does not oxidize, and is th free from the danger of spontaneous combustion, to which all the animal and vegetable less subject. We have almost created a science of lubrication and of lubricants, on reports have been made, of which copies are in Mr. Montgomery's and Mr. Shove's hands

In this matter of lubrication I am inclined to think that you are wasting your money sold under a fancy name; wasting your power for want of a true knowldge of the art of l incurring a useless and entirely avoidable danger of spontaneous combustion and of fric

Your problem is somewhat different from the problem in the cotton-mill, but not may, perhaps, assume that you are not well informed on this matter. I found our cotto thought they knew everything, in fact, with very few exceptions, knew nothing about oils. fore submit a few elementary principles.

Water would be the best lubricant if it did not corrode metals, and you could give it or viscosity to make it stay between the bearing surfaces.

What then comes nearest to water in its fluidity? Manifestly the oils made from pe as mineral oils. At first the lighter or more fluid oils, which with one or two exceptions atile, were in use; but while the oil on the bearings was safe, the vapor distilled by the bearings at ordinary temperature was dangerous, and there was great danger of the bea dry from evaporation. When we discovered this fact we partly coaxed and partly con manufacturers to adopt the safe method of distillation, which had been invented chiefly by Mr. Rufus Merrill, of the Downer Oil Co., of Boston. Our standard for all light t cotton machinery itself is now a pure mineral oil, which has a fire test of 300° Fahre which will evaporate less than 5% in twelve hours at 140° F., and which possesses the consistent with these other conditions. Now, this oil does not oxidize or dry, and it is lutely free from any danger of spontaneous combustion. You may neglect waste satur oil to any extent, and yet it will not heat. It is chemically impossible.

But when you come to heavier bearings more viscosity is required, and what is called greater body in order to keep the lubricant between the bearing surfaces. No general rule can be laid down on this subject, except this: *There is no necessity of making use of any pure oil, mixed oil, or grease, which is subject to spontaneous combustion.* All the animal and all the vegetable oils are thus liable, but they can each be made safe by a suitable admixture of mineral oil. On the other hand, there are special products of petroleum, such as valvoline, cylinder oil, etc., etc., which are very heavy, and therefore suitable for heavy bearings; these oils are also free from the fatty acids of the animal greases which often do so much mischief in steam engines.

Linseed and cotton seed oil are most liable to oxidation, and are absolutely unfit for lubrication. The common adulteration of lard oil with cotton seed oil is one of the most dangerous frauds; because lard oil is so much used for lubrication, and is of necessity used in machine shops on cutting tools. Castor and olive oil come next in the tendency to oxidation, and have ceased to be used by our members for lubrication, as being unsuitable and dangerous. Sperm and neatsfoot oils are relatively safe, oxidizing slowly, but it is difficult and costly to obtain pure qualities. All mixed oils which are sold under fancy names, of necessity consist of some kind of compound of one or more animal or vegetable oils or greases, with a light mineral oil. Tallow oil is much used in such mixtures. You can make pure lard oil safe as to spontaneous combustion by mixing over 35% mineral oil with it; but if it is adulterated with cotton seed, it may take 75%. If you cannot get a heavy and honest mineral oil suitable for your special conditions, from such concerns as the Downer Oil Co,, of Boston, or from the Thompson & Bedford Co., of New York, or other reputable manufacturers, your best way is to take expert advice and learn to mix your own materials. Each heavy bearing has substantially a law of its own which you can discover and then treat it with its proper lubricant. This lubricant may be an absolutely safe one. It is a simple art, and you can readily insure economy and safety. We have arrangements with the experts of the Massachusetts Institute of Technology, and any member of our company who suspects an oil sends me a pint, which I have tested and report upon it at trifling cost. Mr. Montgomery can have the same tests made for you. This is a matter of the most importance to the woolen manufacturers, who use lard and olive oils on their wool, and who must have pure oil, not only for safety, but for the right working of the wool. I venture to guess that having driven all the volatile lubricants and most of the mixtures out of the factories of New England, their principal market is now out West. In Mr. Montgomery's statement of the causes of forty-six fires in flouring mills insured in his company in five years, I find the following causes which are common to all risks:

Lightning,	2
Defective flue,	1
Spark on boiler house roof,	1
Communicated from other buildings,	2
Unknown,	3
Boilers setting woodwork of boiler house on fire,	2
Explosion of a kerosene lamp,	1
Spark from locomotive,	1
Total,	13

None of these causes are apt to make very dangerous fires if the mills are properly constructed and well protected. We now come to friction, lubrication, oil, and spontaneous combustion. Now mark this: We have not had any serious loss from the friction of a heavy bearing since we made lubrication almost an exact science; and there is no reason why you should use an oil or grease in your flour mill which can produce spontaneous combustion. The latter cause of fire is most dangerous, because such fires almost invariably occur in the night. Here is Mr. Montgomery's experience:

Friction, particular machine not named,	4
Friction in elevator,	5
Spontaneous combustion,	6
Hot boxes of purifiers,	3
Friction in conveyor shaft of bolting chest,	3
Friction in separator,	2
Total,	23

Just one-half of the whole number.

Finally there are attributed to incendiary 10

According to my experience 8 of the 10 incendaries were rats or mice who carri concealed spaces, either to eat or of which to build nests; else it was oil or grease pr eous combustion in the usual way. In my judgment not less than 30 of your 46 fire in some way with the use of oil or grease; and it will be either your own fault, or t underwriters, if you do not wholly remove this principal cause of danger. As it is even more in saw-mills and wood-working establishments. Sawdust, impregnated wit imal or vegetable oil or grease, is a most deadly and certain incendiary. I attrib destruction of ice-houses by fire to greasy sawdust which has happened to be in the i ice is packed. If a little more care were taken to keep gudgeon grease by itself, th be safe. The cold of the ice will not prevent the heating of greasy sawdust.

Note pages 47 *to* 49 *inclusive, and part of page* 50, *appendix.*

The problem of steam heating has been solved, and we recommend the safer m the steam pipes overhead, rather than attaching them to the sides of the room. You omy of heat, better circulation, and greater safety. All steam pipes should be kept wood, as such contact is a frequent cause of fire. Any one who denies this is an igno

You will observe that the prevention of loss by fire is a distinct and separate art, under the charge of a special corps trained to prepare to meet all known contingen serve all the new causes of danger. Each principal fire almost always teaches us None of the members of this corps should be permitted to have the slightest personal i pliance of any sort. The head of each system should be a judge and an autocrat, but penalty for neglect may be the withdrawal of a policy. Our inspectors are permitte ders; our officers do not undertake to control or manage any member's business. We we advise nothing which is not for the interest of the member to adopt, without the the underwriter, or the rate of premium. If our advice is not acceptable, we only re our policy. It is now almost a cause of commercial discredit to be thrown out.

Order and cleanliness enforced by frequent inspection, and a well-drilled fire depar are the paramount rules for safety. We inspect quarterly, but weekly inspections by of the members themselves, are more effective than any possible inspection by the und forms may be made out to fit each part, and the inspections may be made by superinten chanics, or overseers. You will observe that the inspector is not called upon to write a pencil through the word which indicates the condition, or else places a sign in the p

GENERAL REPORT.

Risk No.

.....*Mills,*

At.....*in the opinion of the undersigned, this risk is AS A WHOLE,*

INDIFFERENT. FAIR. GOOD. EXCELLENT.

Special Faults or Remarks.

.....

.....

.....

.....

.....

.....

.....

.....

.....*Inspector.*

1. GENERAL ORDER. Indifferent. Fair. Good. Excellent.
2. STEAM PIPES. Combustible Matter on Steam Pipes.
   Pipes Overhead. All Clear.
3. REMOVAL OF WASTE. Neglected. Removed Properly.
4. CLOSETS. Dirty. Clean.
5. FIRE DOORS. Out of Order. None. Good Order.
6. LANTERNS. Oil. Kerosene. Open at Top. Open at Bottom.
   Special Watchmen's. Indifferent. Good. Excellent.
7. PUMPS TRIED. Apparent Good Order.
   Fair Order. Good Order.
8. RESERVOIR. Private. City. Holly. Stand Pipe.
   Stream Feeble. Good. Very Good.
   Diameter of Main, inch. feet above yard.
9. TANKS. gals. capacity. Depth,
   Height of bottom above highest Sprinkler,
10. HYDRANTS. Neglected. Fair Order. Good Order.
11. HOSE AND APPLIANCES.
    Neglected. Fair Order. Good Order.
12. CASKS AND PAILS. Good Supply. Scant Supply.
    Neglected. Part full. All Full.
13. AXES AND BARS. None. Well Distributed.
14. FIRE ORGANIZATION. None. Fair. Good. Excellent.
15. SPRINKLERS, *In Picker or Duster*,—None. Perf. Pipe.
    Automatic. Insufficient. Adequate.
    In Main Building,—None. Perf. Pipe. Automatic.
    Over Loose Stock. Over All. Insufficient. Adequate.
    Name of Automatic } Parmelee. Grinnell. Burritt.
    Sprinkler, } Brown. Bishop. Walworth.
    Supplied by— Reservoir. Tank. Pump.
    Access to Valves,—Inside. Outside. Bad. Fair. Good.
16. WATCH RECORDS. Bad. Fair. Good. Excellent.
17. NUMBER OF MEN in Yard during the night,
    On active duty,
18. HOW LIGHTED. Lamps. Gasoline. Retort Gas. Electricity.

Notes "A" and "B," pages 50 *and* 51, *"C" p.* 52, *"D" p.* 53, *"E" p.* 54, *appendix.*

The inspection cards like those last given, which are sent in by our inspectors are all copied and distributed among the several insurance companies, and a sheet copy is sent by one of the executive officers to the principal or owner of the mill, to whose attention all faults are called. If these are serious and are not remedied, the policy is cancelled on the second or third report. This seldom happens; no one can afford to go out when once in. What, then, should you do in broadening and extending the functions of the Millers' Mutual Insurance Companies? Let us see: Applying the law of chances to our factory combination, we find that after establishing all the safeguards which can be reasonably adopted with a due regard to true economy in construction and use, the average chance of damage to each risk

of 25 per cent is once in about 100 to 125 years, or annually in one out of 100 or 12[illegible] average chance of a total loss once in about 400 to 500 years on one factory, or one in [illegible] to 500. This is the maximum chance, and since these figures were compiled we have the chances. These figures cover our whole experience from the beginning. Our co when a sufficient number of risks are combined to make the sum of the premiums of o one maximum risk taken, it is safe to begin business; but most of us have an annual two or three maximum risks. It is possible to have two maximum losses or several lesse losses in the same year, but they very seldom happen in this order.

If you contribute your present high rates of premium, you would be very safe to be way, because 20 members at 5 per cent or 25 at 4 per cent on even risks would suffice. ever, advise a greater number.

If I am correct in my judgment that a flour mill can be made as safe as a cotto where you are. We should not hesitate to begin on:

40	mills	$ 30,000	each	$1,200,000	1 %	$12,000
40	"	40,000	"	1,600,000	1 %	16,000
60	"	60,000	"	3,600,000	1 %	36,000
40	"	80,000	"	3,200,000	1 %	32,000
20	"	100,000	"	2,000,000	1 %	20,000
200				$11,600,000		$116,000

Here would be 200 chances of loss on a premium equal to one maximum risk, plus t and a margin over, while the average chance of a total loss is only one in four to five maximum.

Now suppose you put in,

5	flour mills	$250,000	each	$1,250,000 at 5 %	$62,500
20	"	100,000	"	2,000,000 5 %	100,000
30	"	50,000	"	1,500,000 5 %	75,000
100	"	10,000	"	1,000,000 5 %	100,000
45	elevators	20,000	"	900,000 2½%	22,500
200				$6,650,000	$360,000

If 5 % is too much, lower to 4 % and increase the number. But bear in mind th should be high to give the stability of a cash fund. It is the dividend or return of unc ium which is the matter of greatest import. Don't haggle about rates in a mutual com they are equitably adjusted. Here you have also 200 chances of fire on $360,000 dep five maximums of $250,000 each. If I am correct in my judgment of the risks, *after* the made good, *after* the pumps and pipes established, and *after* the automatics are everywh not average a loss and expense account exceeding $60,000 a year, and you would then s On $6,650,000 insured on cotton and woolen mills our average chance of loss would $20,000 a year. So much for the general principles and methods.

You have an excellent beginning in the Millers & Manufacturers Mutual Companies lis, Chicago and elsewhere. You have excellent and skillful officers who are familiar w of your risks and the standing of your members. The latter is essential to success. Th depends upon mutual good faith and confidence in each other. The integrity of the essential an element as the quality of the risk. We have had, in our company, but a s of a fire being set by the owner, and after ten years that suspicion was removed by the co real incendiary.

Your error, if any, is that you do not take as broad a gauge in this matter as you d your work; you look upon a policy on a single risk of $10,000 to $20,000 as a large o $200,000 in our own company, and the combined Mutuals write over $1,000,000 on any s risk. If your companies are rightly organized, if they take concurrent action and there number of good risks sufficiently apart from each other to be taken separately, a mut

just as safe to issue policies of $100,000 each as $5,000. It is only a question of numbers. Nor is it necessary that the policies should be in even sums or at even rates.

The judgment and skill of the underwriter come in in the determination of the amount to be carried on each risk and the rate to be imposed. There are cases where we are content to carry $100,000 to $200,000 each on a row of mills only fifty or sixty feet apart; because we know that all their pumps, pipes and hydrants are connected and each can aid the other. The losses in the principal factory cities have been ratably less, notwithstanding the proximity of the mills to each other, than in the country class, so called, which consists of detached or isolated mills.

If a fire gets a good headway in the isolated mill it cannot be saved; but in the well organized city, where each corporation can aid the other, the fire may be stopped, even if severe damage is, incurred. If you take the right measures for self-protection, all your mills in the city could be carried in combination with the isolated mills elsewhere. It all depends upon yourselves.

If I had a complete list of all the elevators, flour-mills, breweries, machine shops, barrel factories, furniture factories, tanneries, agricultural implement factories, and the like, which ought to be in this combination, giving the combustible value of each, it would be easy to make a formula for the work. Another advantage in these combinations is that we give a blanket policy on the mill and contents; provided, the assured, after himself making an estimate of the value of the property which can be burned, satisfactory to us, will carry insurance to the amount of 90% of such so-called combustible value. Many of our members carry 100%, while others carry also what are called "use and occupancy" policies in stock companies, by which they become entitled to so many dollars a day while the product of the mill is reduced in consequence of a fire. These are analogous to policies on rents or freight money. We object to *profit* insurance, but do not object to contracts of indemnity for actual expenses incurred while the damage by fire is being repaired, although we do not issue such policies ourselves.

Again, when a loss occurs, the underwriters assist the owner in ascertaining the amount of loss in order that we may pay the exact measure of indemnity. Our object is to pay justly and not to avoid payment. If the assured tries to get more than his just measure of indemnity, or shows any signs of sharp practice in a settlement, regular adjusters are appointed, and the loss is paid when determined. But we never renew a policy to such men. You may desire information as to assessments; the liability is for a sum equal to five times the annual premium; one or two assessments were made in the early history of the business, over forty years ago—none since. We have twice returned the whole premium; the interest and profits on a change of the investments in certain years, covering small losses and all expenses.

I believe this exhausts the technical details of the system. Our documents are voluminous, and may all be examined by you in this set which I shall leave with Mr. Shove, in Minneapolis, and which Mr. Montgomery has in Chicago. I beg you to understand that this address is purely missionary work. Our companies do not extend their lines west of Buffalo, and only a few of them south of the Potomac, and the Factory Mutuals do not attempt to increase the number of classes of property now insured by them. I, of course, have no personal interest in any of the apparatus to which I have called your attention. But there is a much broader aspect to this question to any one who takes an interest in economic and statistical science. In my recent address before Section 1 of the American Association for the Advancement of Science, I called attention to the vast increase in the value of the property insured against loss by fire, as one of the evidences of the progress of this country since the war.

In 1865 the amount was	$2,564,112,505
" 1870 " " "	4,035,907,596
" 1884 " " "	9,359,423,527

I suppose it is now about $10,000,000,000, of which the Factory Mutuals carry substantially 1-25th part. How much is covered by other mutual companies I have no data here for determining, but the amount is large and the number of mutual insurance companies is, I believe, greater than that of the stock insurance companies.

Note, page 55, *appendix.*

These tables were compiled by Mr. C. C. Hine, in the *Insurance Monitor* for September, 1884.

The aggregate of fire losses is increasing, but the ratio of loss to risk taken is decreasi slow improvement in the methods of construction. Low rates in ratio to the existing r expenses have rendered stock fire insurance of late unprofitable. The increasing num combinations, like our own, is having its beneficent effect. The rubber and shoe manu already organized. The tanners are probably making arrangements thereto in Chicag horse railroad companies are about to organize. The owners of first-class hotels are prep have made a good beginning.

The wholesale dealers in drugs and dye stuffs are also moving. All these are on t tual plan. Other combinations have been or are being made in which the assured may ested in scrip dividends without a liability to assessment. There is no reason why the p become almost universal.

The stock companies in Boston and Philadelphia have also established a strict syst tion, and have engaged two of our best men to set the work going.

All this will lead to judicious discrimination and to improvement in construction. cease to be safe to adopt the methods of combustible architecture, under the apparent p fallaciously cheap, but really very dear contract of indemnity. The enlightened self-i assured, when the assured become more intelligently their own underwriters, will work a is utterly beyond the reach of meddlesome legislation. In this connection let me call you the fact that the Factory Mutuals of Massachusetts and Rhode Island employ no agents in but transact all their business in Boston or Providence. Their members in other States to be insured; therefore their whole business is under the jurisdiction only of Massachuset Island respectively.

There is some jealousy on the part of some of the Stock Insurance Companies in r Mutuals, but it is limited to the weaker companies. The truth is that the interests of th well managed Stock Companies and of the Mutuals are identical.

The fields are ample for both and both systems are needed. It is for the interest of l weak insurance companies, which are got up as asylums for the incapable and which are to insure anything without judgment or discretion, should be weeded out. In this way heavy cost of the conduct of stock insurance be reduced. When this is accomplished, su tions can be imposed on all alike both by Stock and Mutual underwriters, and when it cea to obtain policies of insurance on bad construction and careless occupancy, the loss by fire w diminished while the general cost of insurance will be very much reduced.

But there is yet another reason why I have been glad to do a little missionary work Every dollar which Western producers can save and apply to a reduction in the cost of W may be spent in the purchase of Eastern manufactures. The principal consumers of staple t are the farmers and farm laborers, the artisans, mechanics, and other so-called working pe persons of moderate means, or who depend on each year's work for each year's living, cor 90% of our population and the great bulk of the consumers of our manufactures. To t of the present cost of living is the price of food. The ratios are substantially,

Food, - - - - - - -	50 to 60 per cent.
Clothing, - - - - - -	12 to 18 per cent.
Rent, and all other items, - - -	22 to 38 per cent.

By so much as they can save on food may they spend on clothing and shelter. As the down the ratio of the cost of food goes up. As food costs less, clothing and shelter are e increasing proportion. The labor question, so-called, is rapidly settling itself in this cou of demagogues and sentimentalists.

The economic law may be stated as follows: All profits tend to a minimum while all a maximum, as capital and labor are left free to work together under their necessary rel other. The necessary result is, that the working people of this country are annually rec creasing share of an increasing product. In witness of this statement of the fundament and of the axiom that high wages in money, or in what money will buy, are the necessar

low-labor cost of production, I beg to give you a few figures, and for further details I may venture to refer you to my recent book on the distribution of products lately published by G. P. Putnam's Sons.

Since the end of our Civil War the following changes have occurred on which our future progress may be predicated:

The grain crop of the United States in 1865 numbered 1,127,499,187 bushels.
The crop of 1884 numbered - - 2,981,920,332 "
That of 1885 will probably exceed - - 3,000,000,000 "
The average product of pig iron in 1865, 1866 and 1867 was 1,247,850 tons.
" " " 1882, 1883 and 1884 was 4,971,569 tons.

Increase 299 per cent.

The railway mileage, January 1, 1865, was - - 33,908 miles.
" " " " 1885, " - 125,379 miles.

Increase 270 per cent.

The amount of insurance against fire in 1865, was - $2,564,112,505
" " " " 1884, " - 9,359,423,527

Increase 265 per cent.

The average crop of cotton in 1865, 1866 and 1867 was 2,262,385 bales.
" " " 1882, 1883 and 1884 " 6,122,095 bales.

Increase 176 per cent.

The last twenty crops up to 1884 inclusive, raised by free labor, exceed the twenty last crops raised by slavery, by over 30,000,000 bales; each heavier than the ante-war bale by more than ten per cent. The seed then wasted is now saved and converted to use. The value of this increase, including the use of seed, must have been about $1,800,000,000 to $2,000,000,000; a sum equal to the whole money cost of the war to the South measured at a gold standard, and more than half of what the North spent in money on a currency basis. The debt and taxes incurred by the United States for war purposes came to about $4,200,000,000.

The population of the United States, August 1, 1865, was about 35,000,000; August 1, 1885, 57,000,000. Increase sixty-three per cent.

The public debt of the United States audited and recorded, plus payments due soldiers and contractors not then audited, was August 1, 1865, $2,997,586,203; August, 1, 1885, $1,386,555,527. Decrease fifty-four per cent.

The debt of the United States per capita, August 1, 1865, was $84.00; August 1, 1885, $24.00. Decrease seventy-two per cent.

The constantly increasing debt even of the solvent states of Europe, is now $75 per head; and in this time of passive war, which they call peace, one man in every twenty-two capable of bearing arms is wasting his time in camp or barracks, while another one must spend his time in furnishing subsistence for this worse than idle force. Who can wonder that Nihilism, Communism and Socialism, should be the result of such condition? Who can foresee the remedy for these great wrongs? Well may the thinkers and the prophets of these fair lands of Europe repeat the words of Jefferson, when he condemned American slavery: "I tremble for the future of my country when I remember that God is just."

Such have been some of the principal factors in our account.

These figures give you some idea of our power of production and distribution. The problem now presented to you is this: Will you save this rich abundance, and spend it in beneficent use, or will you waste it by fire for lack of common prudence?

Gentlemen, I thank you for your attention. I once made the first speech in a political meeting where the second was made by a man who had dined out, and had partaken too freely of champagne. The next day a good friend reported that an old lady in the gallery thought it was the funniest meeting she ever went to, "because," she said, "the first speaker was very dry indeed, and the second one had been."

You have had complete evidence that I was the first, but who is the second on this occasion?

APPENDIX.

EXPLANATORY.

Early in September it was learned that Mr. Edward Atkinson, of Boston, a gentleman as a statistician and political economist, and an authority upon matters of fire prevention visit the National Yellowstone Park, and would probably return *via* Minneapolis. Upon Mr. Atkinson was requested by the managers of the Mutual Insurance Companies, named this pamphlet, to address a meeting of Northwestern manufacturers and millers in Min kindly consented to remain there long enough to do so, also procuring from Boston the ments and drawings used to illustrate the lecture. The expectation that the lecture would the Western people, in a concise form, much of Mr. Atkinson's valuable experience has not pointed.

In order to preserve the continuity of Mr. Atkinson's remarks, the various document in the course of the lecture are reproduced in the Appendix, numbered for ready referenc

These are in the main extracts from various "Special Reports," published from time the company, of which Mr. Atkinson is the official head, and, in addition, cuts illustrating plans of buildings referred to, are introduced. These designs are the work of Messrs Whiting and William H. Dabney, Jr., of Boston, Mass. Photo-lithographs of the origina on file in the offices of the Western Manufacturers Mutual Insurance Company at Chica Millers and Manufacturers Mutual Insurance Company at Minneapolis, and can be exam time, or copies can be furnished drawn to any desired scale at cost of draughtsman's se cuts given herewith serve to illustrate the methods, but as the original drawings are of and drawn to different scales, in reducing them to fit these pages, no definite scale could The reproductions, however, were made by the photo-engraving process of the Levytyp so that the relative proportions of the different parts of each cut remain uncl is proper to say that the best interests of our members and those of our companies are ic lie in the direction of prevention of fires by better methods of building, and improved e appliances. Every possible assistance will be given in these matters, with no charge excep expenditures.

Arrangements have been made for testing various lubricants at small cost, about one required for test, which should be sent properly marked with name of sender. Also the and name of house manufacturing it, as well as of whom purchased, should be given This information is desired to avoid the necessity of testing the same oil repeatedly, and al us to recommend houses furnishing good oil. It will not be communicated to those maki It is not likely that the expense of any one test, including express charges, will exceed our intention to put the companies into a position to render material aid and advice to th in the important matter of lubrication as rapidly as possible. This and some other ma touched upon will be given in detail in future special reports.

P. A. MONTGOMERY, *Se*

Note from page 4.

BOSTON MANUFACTURERS MUTUAL INSURANCE COMPANY'S REI

COMPARISON BY CALENDAR YEARS.

STANDARD. FULL PREMIUM 100.

YEAR.	PREMIUM EARNED.	LOSS.	PER CT. LOST.	PROPORTION TO STANDARD.
1851	$18,920.25	$1,983.97	10.5	
1852	35,774.49	6,519.90	18.2	
1853	41,705.78	31,601.15	75.7	
1854	50,103.44	2,714.56	05.4	
1855	64,681.68	37,201.61	57.5	
1856	71,771.09	72,563.80	101.0	
1857	65,808.59	20,622.74	31.3	
1858	62,538.85	3,715.98	05.9	
1859	62,638.88	22,629.36	36.1	
1860	72,020.35	12,771.14	17.5	
1861	77,286.29	12,299.02	15.9	
1862	81,010.91	737.99	00.9	
1863	85,997.95	27,524.37	32.0	
1864	95,371.80	91,288.87	95.7	
1865	79,731.66	45,159.59	56.6	
1866	118,082.67	28,254.37	23.9	
1867	140,031.68	47,064.25	33.6	
1868	173,932.75	65,352.08	37.5	
1869	196,116.13	29,576.97	15.1	
1870	219,501.31	29,590.43	13.5	
1871	233,271.42	8,783.76	03.7	
1872	248,817.44	92,895.43	37.3	
1873	279,086.47	169,338.31	60.6	
1874	300,692.84	133,717.85	44.5	
1875	321,238.15	33,649.48	10.4	
1876	305,031.40	91,229.80	29.9	
1877	351,576.82	167,710.23	47.7	
1878	363,037.55	44,460.37	12.2	
1879	345,154.33	13,803.92	04.0	
1880	375,646.23	201,499.59	53.6	
1881	432,923.65	101,754.86	23.5	
1882	469,309.89	154,416.81	32.9	
1883	509,207.70	123,137.86	24.2	
1884	559,922.66	143,832.18	25.7	
	$6,908,842.31	$2,069,382.60	29.80	
1878 to 1884 Incl.	$3,055,201.51	$782,905.59	25.62	

Average per cent. of premium lost 1851 @ 1877, inclusive, 33.20

" " " " " 1878 @ 1884, inclusive, 25.62

Gain in second period, ... 7.58

The gain in the second period represents the sum of $231,584.13.

The Boston Manufacturers Mutual Fire Insurance Company carries about one-fifth part of policies. The reduction in the rates of loss in this Company is therefore shared by other companies i fore represents a proportionate gain in the last seven years over the previous record of about $1,166,0(the reduction in the rate of premium which has been granted in consideration of increased protection.

NOTE—During the seven years last named, the system of automatic sprinkling has been introduced and very ger safeguard has been required because of the constantly increasing concentration of property by additions in almost all mill ys

Note from page 6.

From Special Report Boston Manufacturers Mutual Insurance Company.

COST ON ONE AND TWO-STORY MILLS.

NORTH CAMBRIDGE, MASS., March 24, 1884.

Dear Sir: In compliance with your request for an estimate of the cost of constructing a mill building in conformity to the plans and specifications issued from your office, I respectfully submit the following estimate for a building 194x220 feet one story high, = 42,680 square feet, with a basement for shafting only; bays 8 feet on centers.

Excavation, 3,223 yards @ 16 cts	$515 68
Foundation wall and pier stone 364 yards @ $6.00	2,184 00
Granite underpinning, window and door sills	972 40
516,636 brick laid @ $16.00 per M.	8,266 18
548 M. lumber @ $24.00	13,152 00
Labor on same	3,836 00
46,392 feet gravel roof @ 7 cts.	3,247 44
Iron and hardware	1,490 50
Paint and glass, 3d quality German glass	1,933 20
42,680 sup. feet = 83 $\frac{4}{10}$ cents per square foot of floor	$35,597 40

In reporting upon the probable cost of a one-story factory building in accordance with the plans which have been submitted to me, I beg to add an additional estimate of the cost of a building, substantially of the same kind, two stories high. You have suggested that while the one-story mill plan may be preferable for the purpose of weaving, and for many other purposes connected with the textile arts, there are yet other branches of that work and also many other employments, for which a two-story mill not exceeding one hundred feet in width would be equally suitable.

The cost of such a mill building, say 98x440 feet, two stories high (41,520 feet each floor, equal to 83,040 square feet in all), with 10.8 bays, with two elevators, would be $54,809.58, or 63$\frac{1}{2}$ cents per square foot.

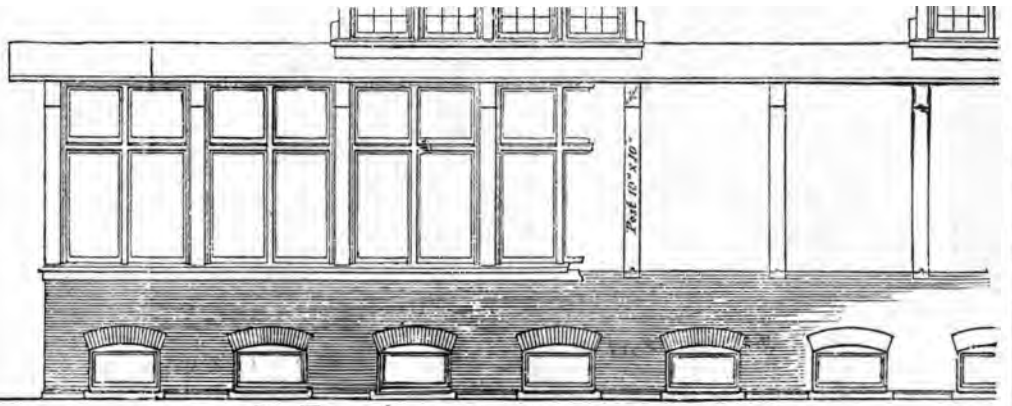
Respectfully yours,

A. H. KELSEY.

EDWARD ATKINSON, President,
Boston Manufacturers Mutual Fire Insurance Co.

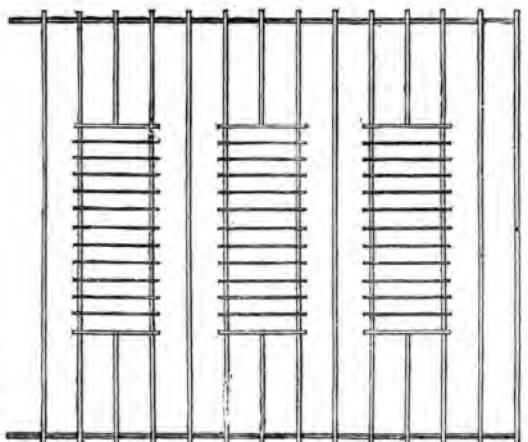
Side Elevation. All Brick.

The Mill should be heated with overhead pipes.

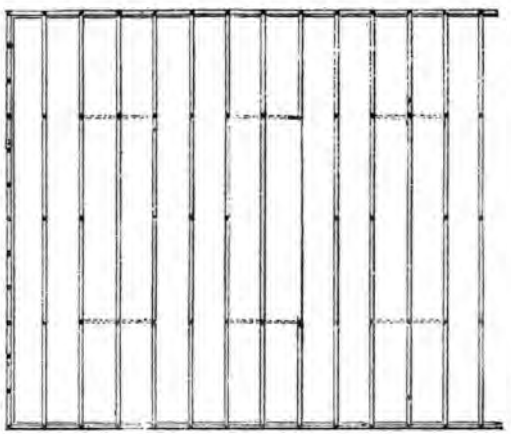


Side Elevation, Timber & Glass above Stool.

If more light is desired the basement windows may be larger



Plan of Roof Timbers.

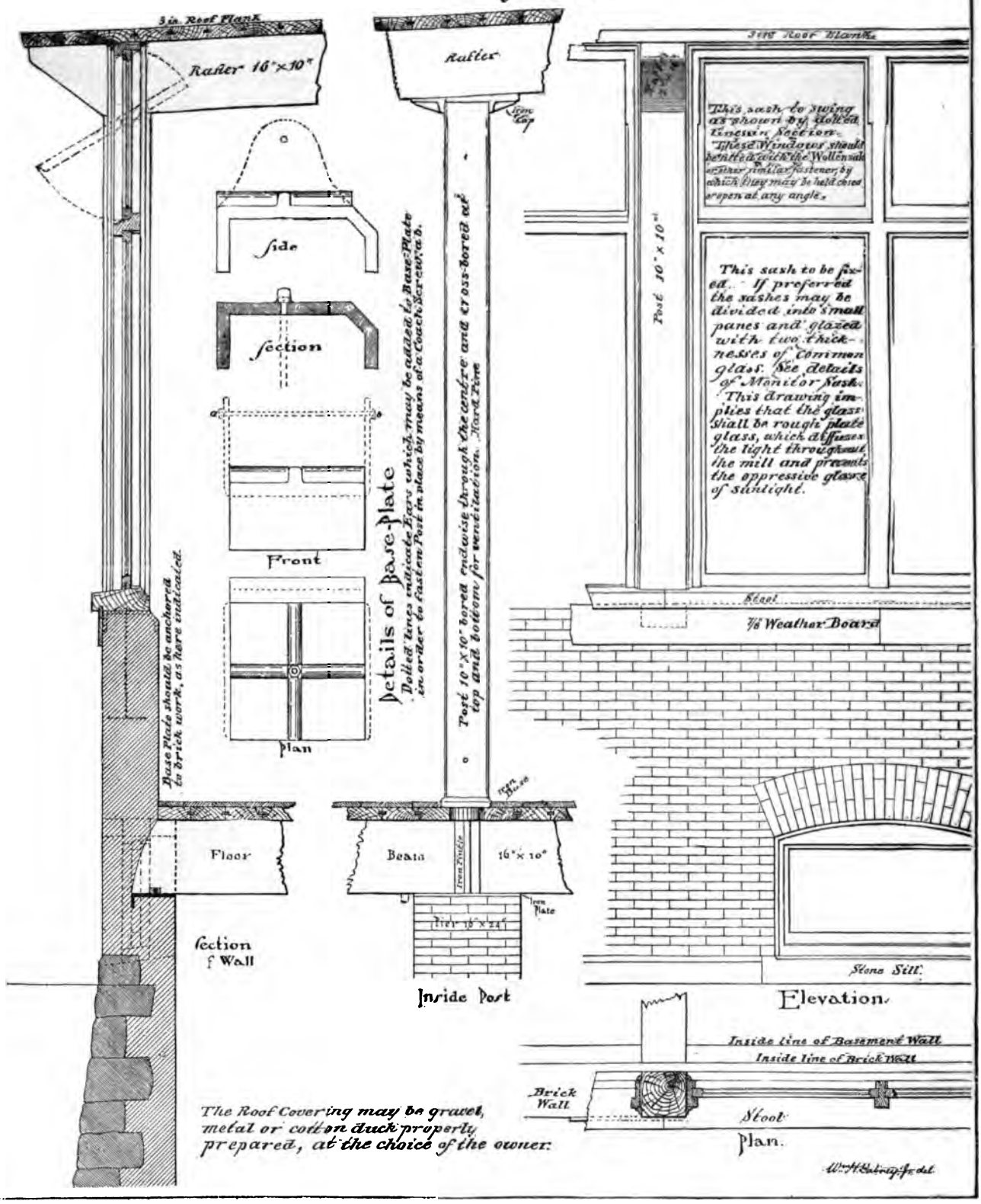


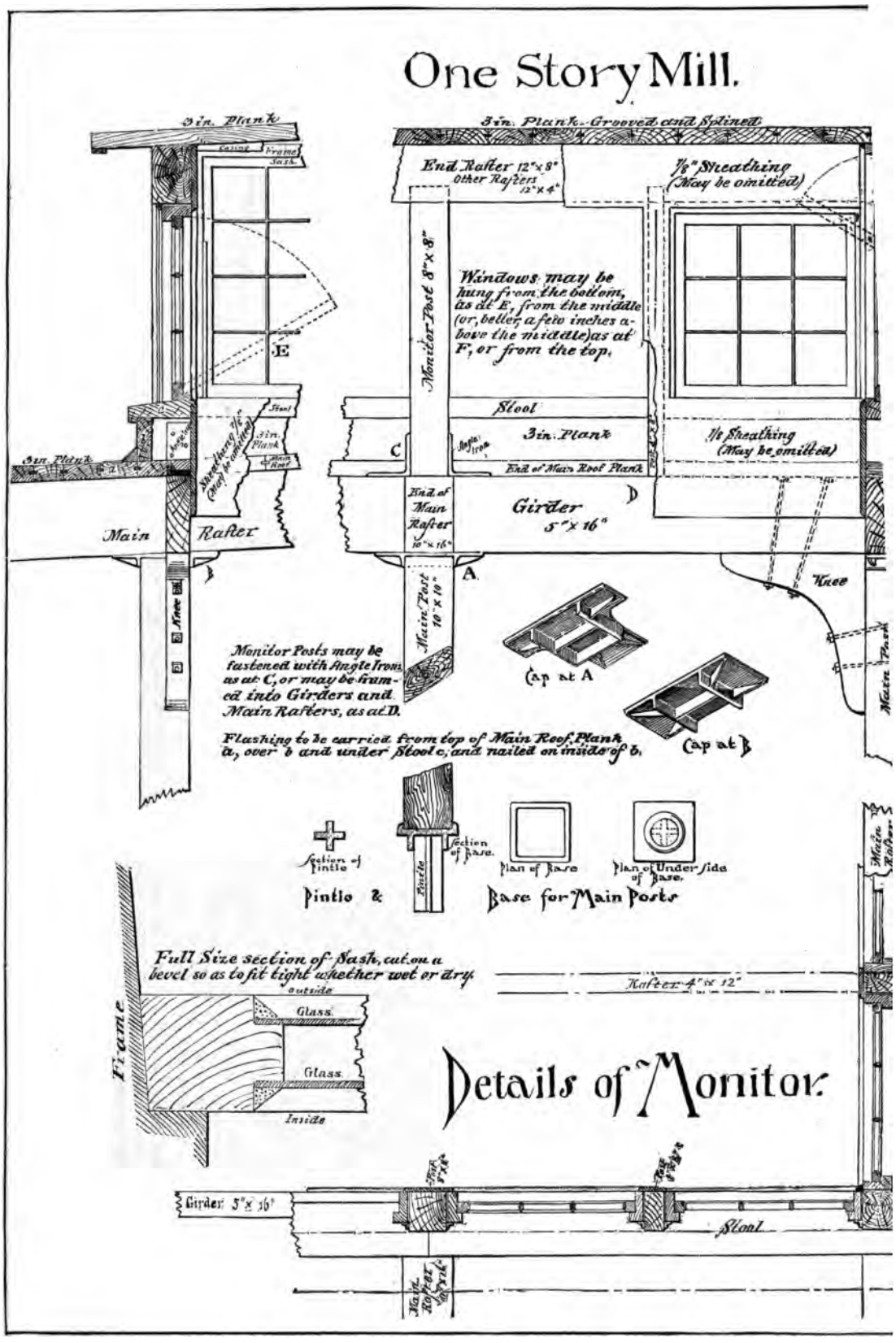
Plan of Floor Timbers.

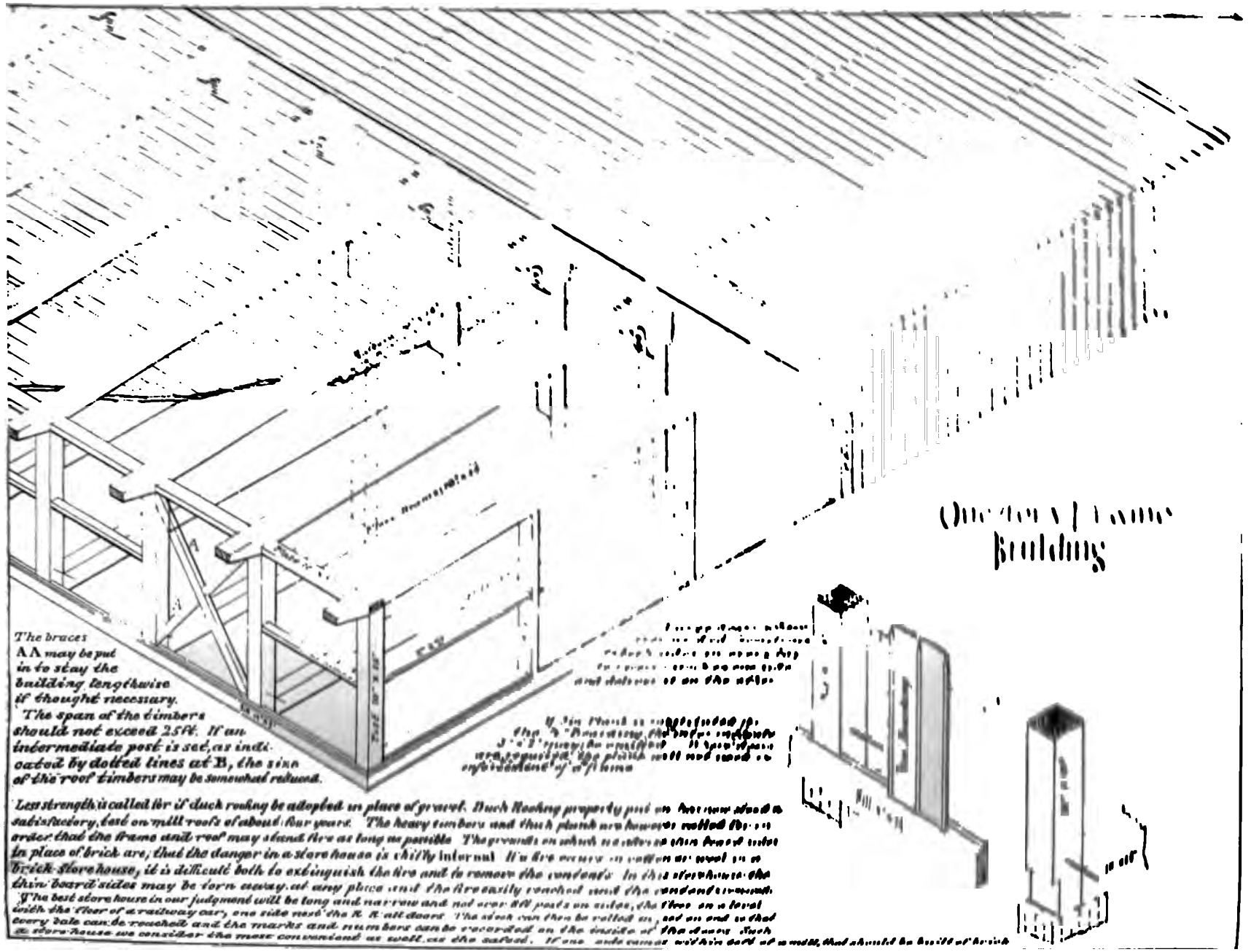
Sidewalk glass may be put in the Floor to light the Basement at such points as the placing of Machinery will allow in this way so much light may be transmitted from above as to warrant the conversion of this plan to the purpose of a very wide two story mill with full sized windows 6½ x 4½ in each bay in the lower story.

No. 2

One Story Mill.




One Story Mill.
3in. Plank
3in. Plank - Grooved and Splined
End Rafter 12"x8"
Other Rafters 12"x4"
1/8" Sheathing (May be omitted)
Monitor Post 8"x8"
Windows may be hung from the bottom, as at E, from the middle (or, better, a few inches above the middle) as at F, or from the top.
Stool
3in. Plank
1/8 Sheathing (May be omitted)
End of Main Roof Plank
End of Main Rafter 10"x16"
Girder 5"x16"
Main Post 10"x10"
Main Rafter
Knee
Monitor Posts may be fastened with Angle Irons, as at C, or may be framed into Girders and Main Rafters, as at D.
Flashing to be carried from top of Main Roof Plank a, over b and under Stool c, and nailed on inside of b.
Cap at A
Cap at B
Section of Pintle
Pintle
Section of Base.
Plan of Base
Plan of Under side of Base.
Pintle & Base for Main Posts
Full Size section of Sash, cut on a bevel so as to fit tight whether wet or dry.
outside
Glass.
Glass.
Inside
Frame
Rafter 4"x 12"
Details of Monitor.
Girder 5"x 16"
Stool
Main Rafter 10"x16"

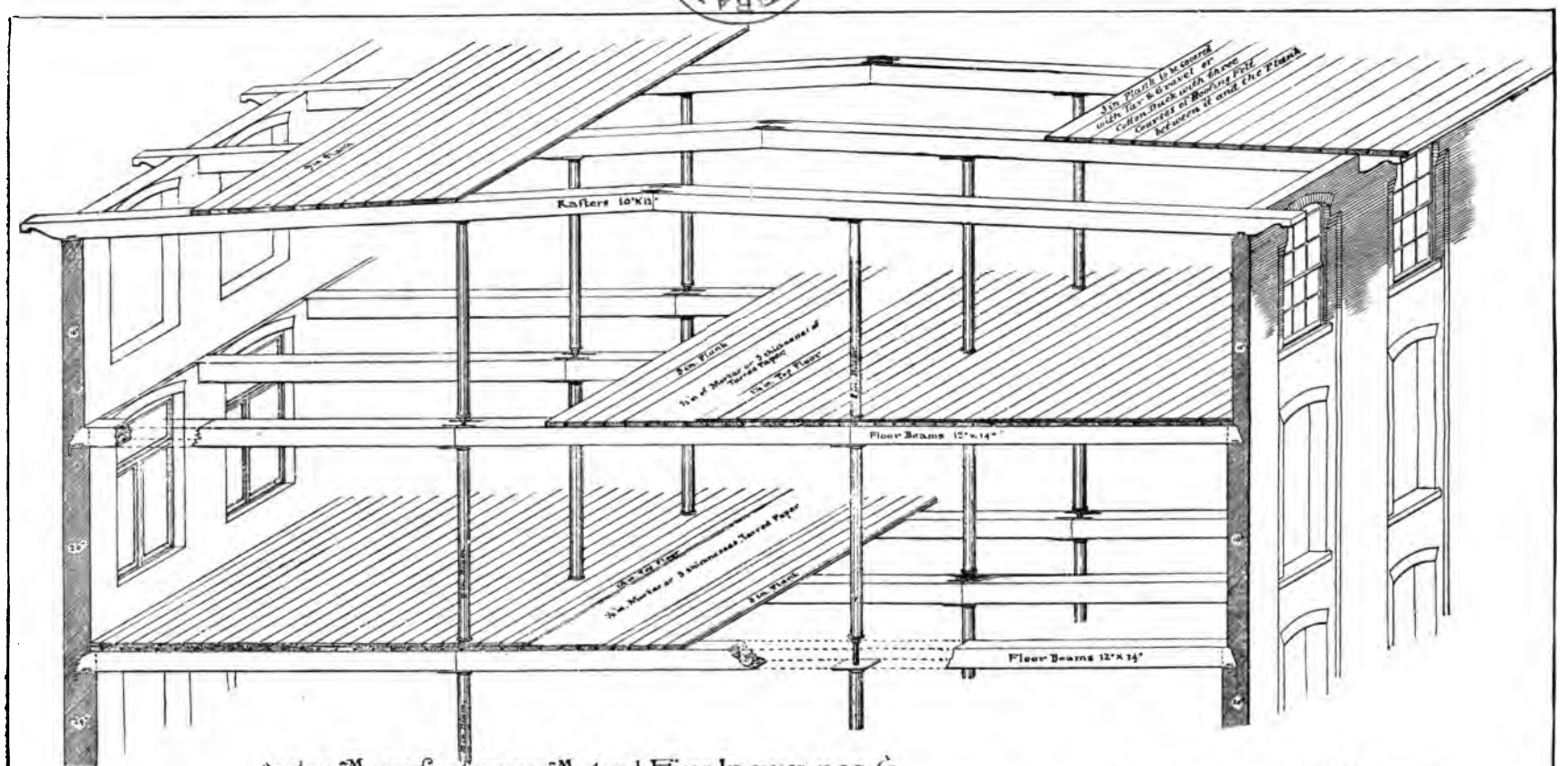


The braces AA may be put in to stay the building lengthwise if thought necessary. The span of the timbers should not exceed 25ft. If an intermediate post is set, as indicated by dotted lines at B, the size of the roof timbers may be somewhat reduced.

Less strength is called for if duck roofing be adopted in place of gravel. Duck Roofing properly put on [illegible] is satisfactory, based on mill roofs of about four years. The heavy timbers and thick plank are however recommended in order that the frame and roof may stand here as long as possible. The grounds on which the stores are built should be in place of brick are, that the danger in a store house is chiefly internal. If a fire occurs in cotton or wool in a brick store house, it is difficult both to extinguish the fire and to remove the contents. In this store house the thin board sides may be torn away at any place and the fire easily reached and the contents removed. The best store house in our judgment will be long and narrow and not over 40 feet wide, the floor on a level with the floor of a railway car, one side next the R. R. at all doors. The cars can then be rolled in, and on end so that every bale can be reached and the marks and numbers can be recorded on the inside of the doors. Such a store house we consider the most convenient as well as the safest. If one [illegible]

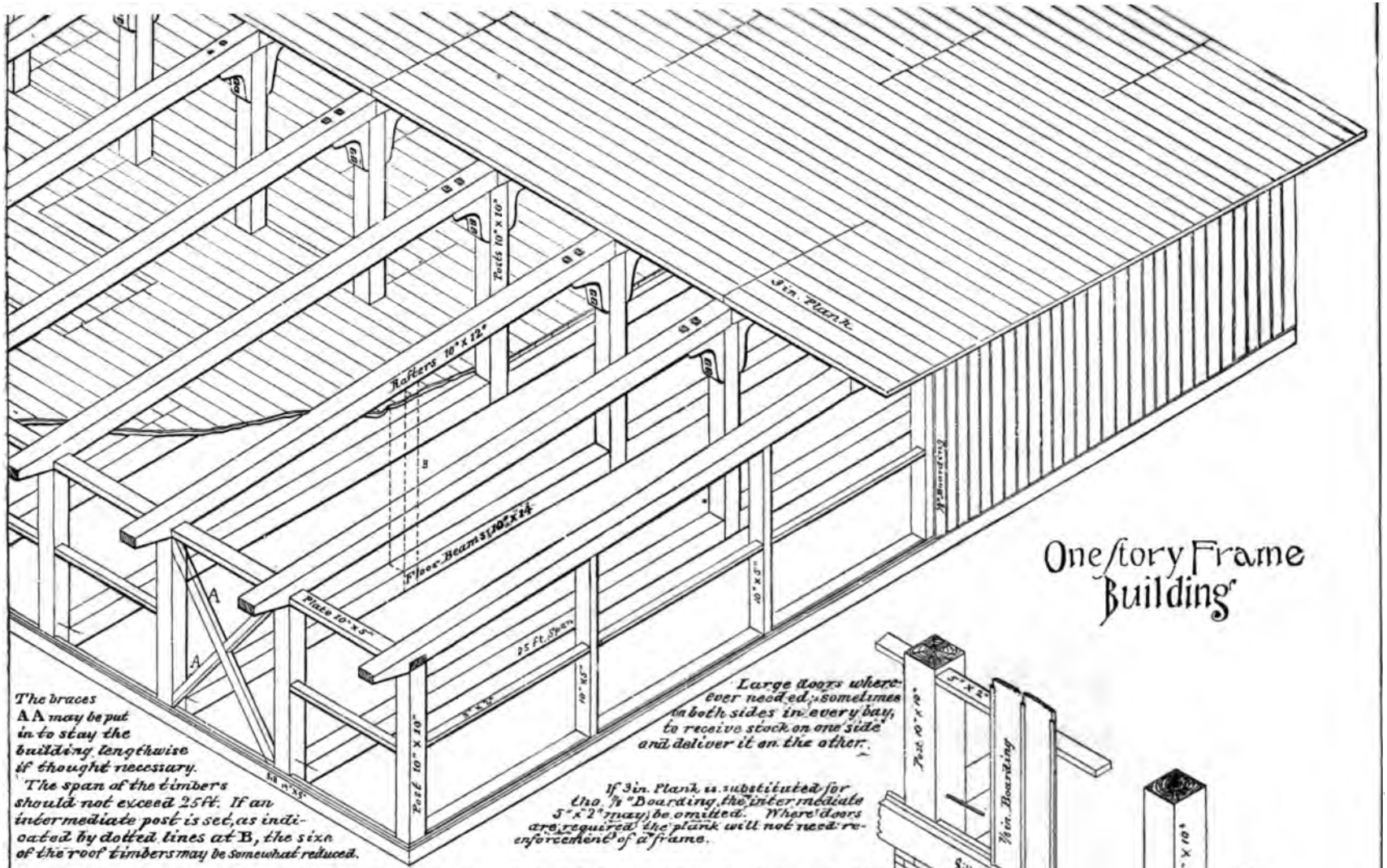
Brushing

LIBRARY



Boston Manufacturers Mutual Fire Insurance Co
Section of Mill, showing Construction of Two Floors & Roof

One story Frame Building



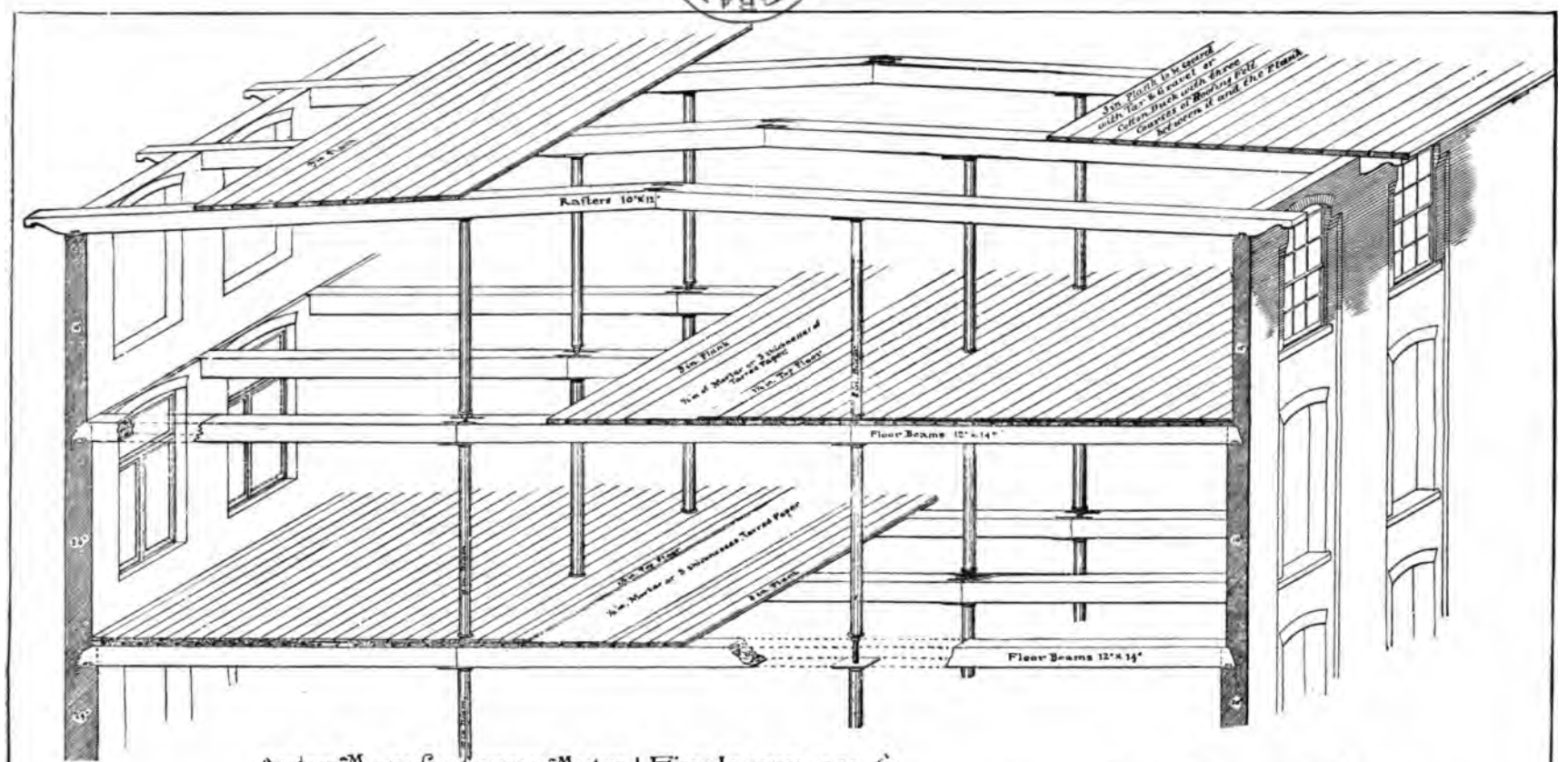
The braces **A A** may be put in to stay the building lengthwise if thought necessary. The span of the timbers should not exceed 25 ft. If an intermediate post is set, as indicated by dotted lines at **B**, the sizes of the roof timbers may be somewhat reduced.

Large doors wherever needed; sometimes on both sides in every bay, to receive stock on one side and deliver it on the other.

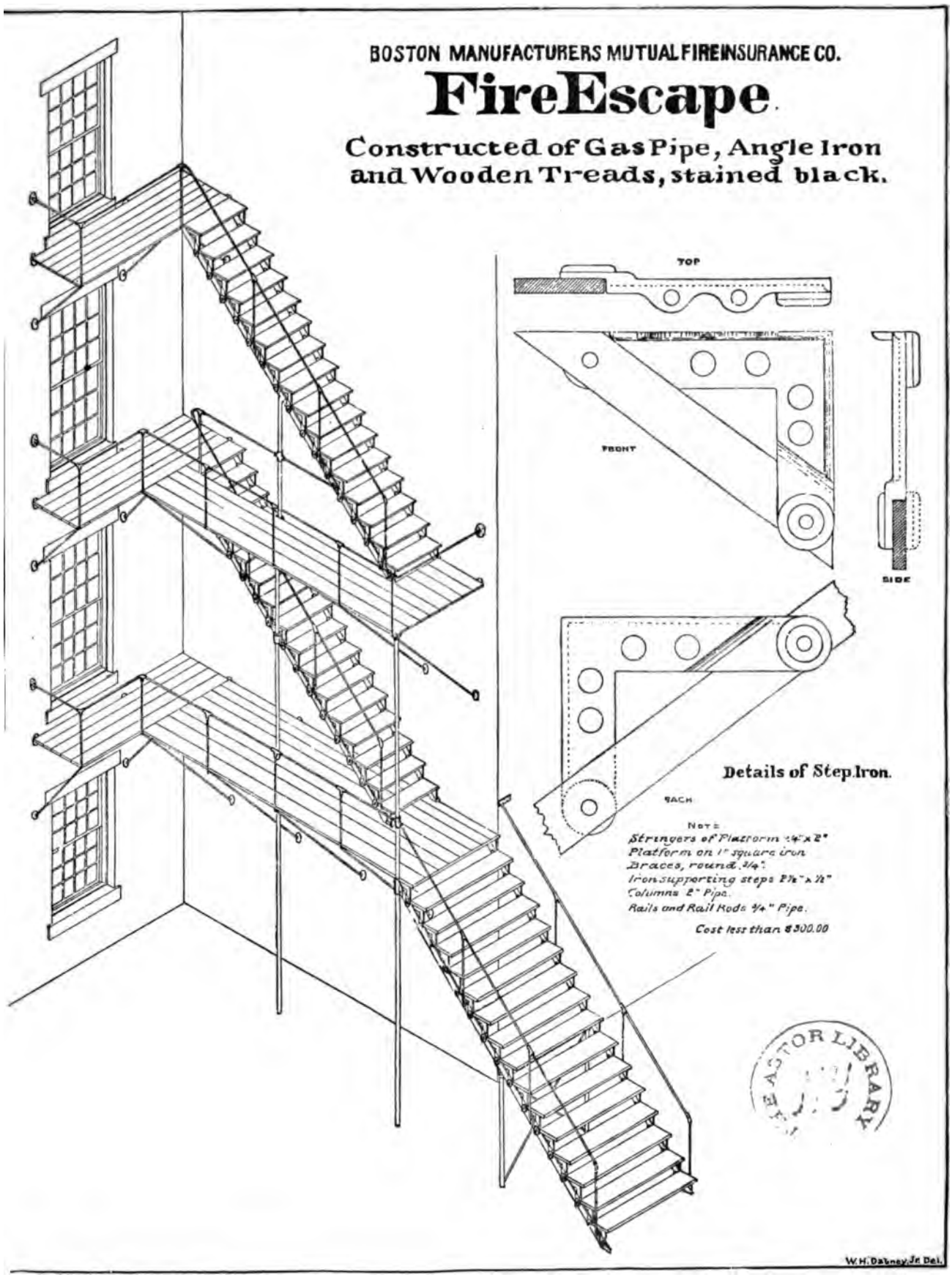
If 3 in. Plank is substituted for the ⅞ "Boarding, the intermediate 5" x 2" may be omitted. Where doors are required the plank will not need reenforcement of a frame.

Less strength is called for if duck roofing be adopted in place of gravel. Duck Roofing properly put on, has now stood a satisfactory test on mill roofs of about four years. The heavy timbers and thick plank are however called for in order that the frame and roof may stand fire as long as possible. The grounds on which we advise thin board sides in place of brick are, that the danger in a store house is chiefly internal. If a fire occurs in cotton or wool in a brick store house, it is difficult both to extinguish the fire and to remove the contents. In this storehouse the thin board sides may be torn away at any place and the fire easily reached and the contents removed. The best store house in our judgment will be long and narrow and not over 80 ft. poses on sides, the floor on a level with the floor of a railway car, one side next the R. R. all doors. The stock can then be rolled in, set on end so that every bale can be reached and the marks and numbers can be recorded on the inside of the doors. Such a store house we consider the most convenient as well as the safest. If one side comes within 60 ft of a mill, that should be built of brick.

THE ASTOR LIBRARY



Boston Manufacturers Mutual Fire Insurance Co
Section of Mill, showing Construction of Two Floors & Roof



EASTOR LIBRARY

SUGGESTIONS FOR WHAT MAY BE CALLED A PORTABLE FACTO

THIS SERVES THE PURPOSE OF AN EXHIBITION FIRST, AND AFTERWARD OF A COTTON FACTOI PLACE IF ITS REMOVAL IS DESIRED.

The plans submitted herewith have been prepared at the instance of the undersigne to the cheap and rapid construction of a building that will serve the purposes of Cotton Exhibition at Atlanta, and may also be a good model for factories, gin hou establishments that will be needed in the Southern States, where timber is very abunda objected that a wooden building is more liable to destruction by fire than one nominally or stone, but this objection has little force if the building is to be of only one or two sto and if no wood is used less than two and one-half to three inches thick except the top flo be one inch in thickness. In the exhibition building a top floor may not be required at al will doubtless be good mill-planed hard pine.

The safety of a textile factory, of a cotton gin house, of an oil-mill, or of a mech which combustible material is used, depends vastly more upon cleanliness, order, discipli water and automatic sprinklers connected with an adequate reservoir, than it does upon t which the outer walls are composed; and if a fire gets beyond the control of such appar bustion of the contents will not leave much of the building itself in any case, of whate is constructed.

The method of construction submitted herewith carries nearly its full specification up the drawings.

The roofing material that would be best adapted to the building, if it is put up for t would be a heavy duck or osnaburg thoroughly saturated with mineral paint. We have doubt that such a covering would serve for permanent use, but as it is as yet on trial for we can only judge of its permanent fitness by the long practice in covering steamboat d cars, etc., with such a covering.

If it is cheaper or is considered to be better, the greater part of the sash on the sides ing may be made whole rather than in two sections like a common window; such sash to b and not arranged to open or shut as the windows in the monitors on the roof are the chie for ventilation.

So far as it may be expedient to arrange for ventilation at the sides, it can be comp ing panes in such fixed sashes.

This method of fixed sash is best because it does away with boxed window frames, pul and cords.

In the climate of the North it is necessary that the windows in the monitors shall be dows, else the moisture generated in the mill will condense on the glass, and freeze; when thaws there will be a drip inside that will injure the machinery.

In the South it might not be necessary to provide against this contingency, but it is su a heavy solid window-frame should be used, set with double plates of glass with an air sp by this method heat as well as cold may be excluded.

On the sunny side of the mill it would be well that one of these plates should be of c corrugated glass so as to exclude the glare of the sun and do away with the need of windo

With reference to hot weather and the need of shade, it is also suggested that the roof outside the walls at least four or possibly five or six feet.

With a little ingenuity in the use of bolts, nuts and trenails, the taking apart and re of this building, either as a whole or in sections, may be readily accomplished.

The building may be of almost any dimensions either in width or length, because the and ventilation from the monitors makes all consideration of side light or side ventilation Assuming the form of the Greek cross as the one chosen, each arm had better be 72 feet width implies two rows of posts, giving 24 feet span to the timbers; the timbers being 8 centres.

A square building or a parallelogram may perhaps be cheaper forms for use but not q taken apart to be put up in smaller sections.

The monitors or lanterns are to be placed across the building, and are to cover each a of bays in a large building; in a small one each alternate bay.

In the basement there should be an intermediate post or pier to each span of the tin spaces between the posts or piers in the basement 12 feet across the width, 8 or 9 feet on the structure.

It will be observed that every part of this building can be worked to order at the saw mill or the sash factory, and will only need to be put together at its place of use.

Care should be taken that every part is interchangeable as far as may be, and that all the bolt, screws and nuts are also of like character.

In fact, the plan of the whole structure may suggest to lumber dealers the expediency of entering into a regular manufacture of portable factories, gin houses and perhaps dwellings. It would be perfectly feasible to adopt several plans of interchangeable structures suited to these several uses.

The basement ought to be high enough to carry all the shafting if it is desired to belt all machines through the floor.

For temporary use, such shafting could be carried on trestles or horses firmly set and braced; for permanent use it is best to have all the main lines in trenches on a firm and separate foundation, where it can be kept under substantially uniform conditions of temperature, free from much expansion or contraction, and not liable to be thrown out of line by any twisting, warping, contraction or other change in the timbers of the building. Economy of power demanding the most stable conditions in the alignment of shafting that can be attained.

If it is desired to have the shafting overhead and to belt from above, the high basement may be dispensed with.

For the purpose of an exhibition it would be desirable to have the shafting below so far as it is feasible, as the appearance of a room free from belts is much more satisfactory. This matter may be decided according to the nature of the machinery to be exhibited. In some parts of the building the shafts may be below and in others above.

It will be essential to protect this building, especially when used for the purposes of an exhibition, with the Parmelee Automatic Sprinkler supplied by an adequate reservoir and with other appliances for extinguishing fire, such as are required in all first-class factories.

It will be obvious to any one who desires to construct this building in a more permanent way, that brick or stone, finished smooth inside, may be substituted for wood to the height of the window-stool, and that a heavy sill may be placed upon such wall into which the posts may be framed, and upon which the window-frames may rest.

It is essential to safety from fire that there shall be no furrings, no concealed spaces, no place where fire can spread unseen and out of reach of water, no closet, no cupboard, and no place where oily waste or rubbish may accumulate, causing danger of spontaneous combustion. Every place in the factory must be visible and every corner kept clean. Cleanliness, order, and plenty of pails kept full of water, have saved more factories from destruction by fire than all other methods or apparatus combined.

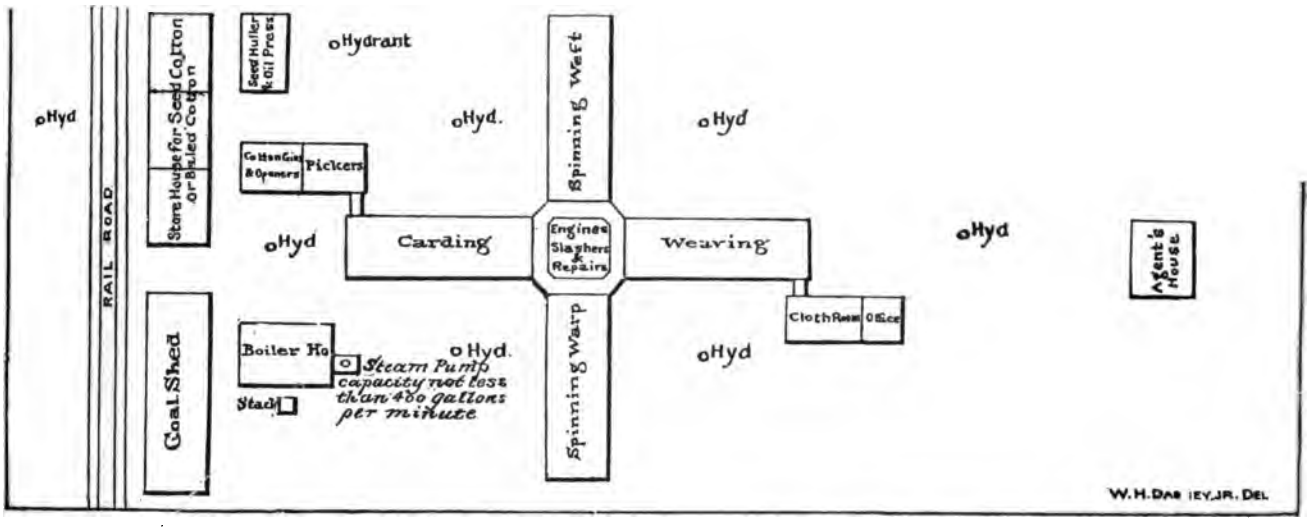
The one-story structure may be put up in several ways, each of which lends itself readily to the convenient placing of machinery. The square or parallelogram may be the cheapest, but the Greek cross or the form of a long letter H may have some advantages.

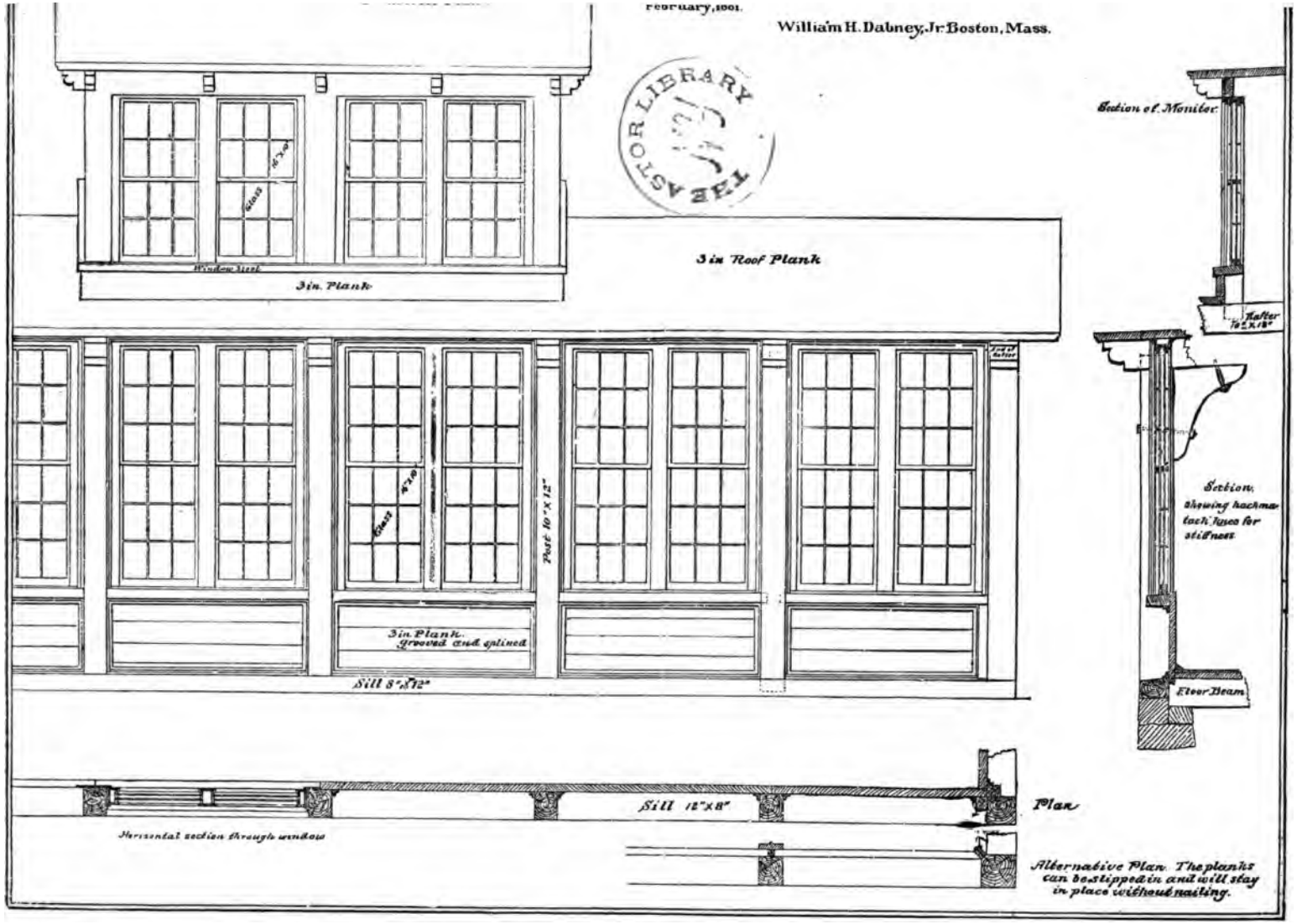
The following plan might serve for a small cotton-mill and its auxiliary buildings, assuming the best method of working seed cotton, and restoring the hulls and oil cake to the farmers to be fed to their stock:

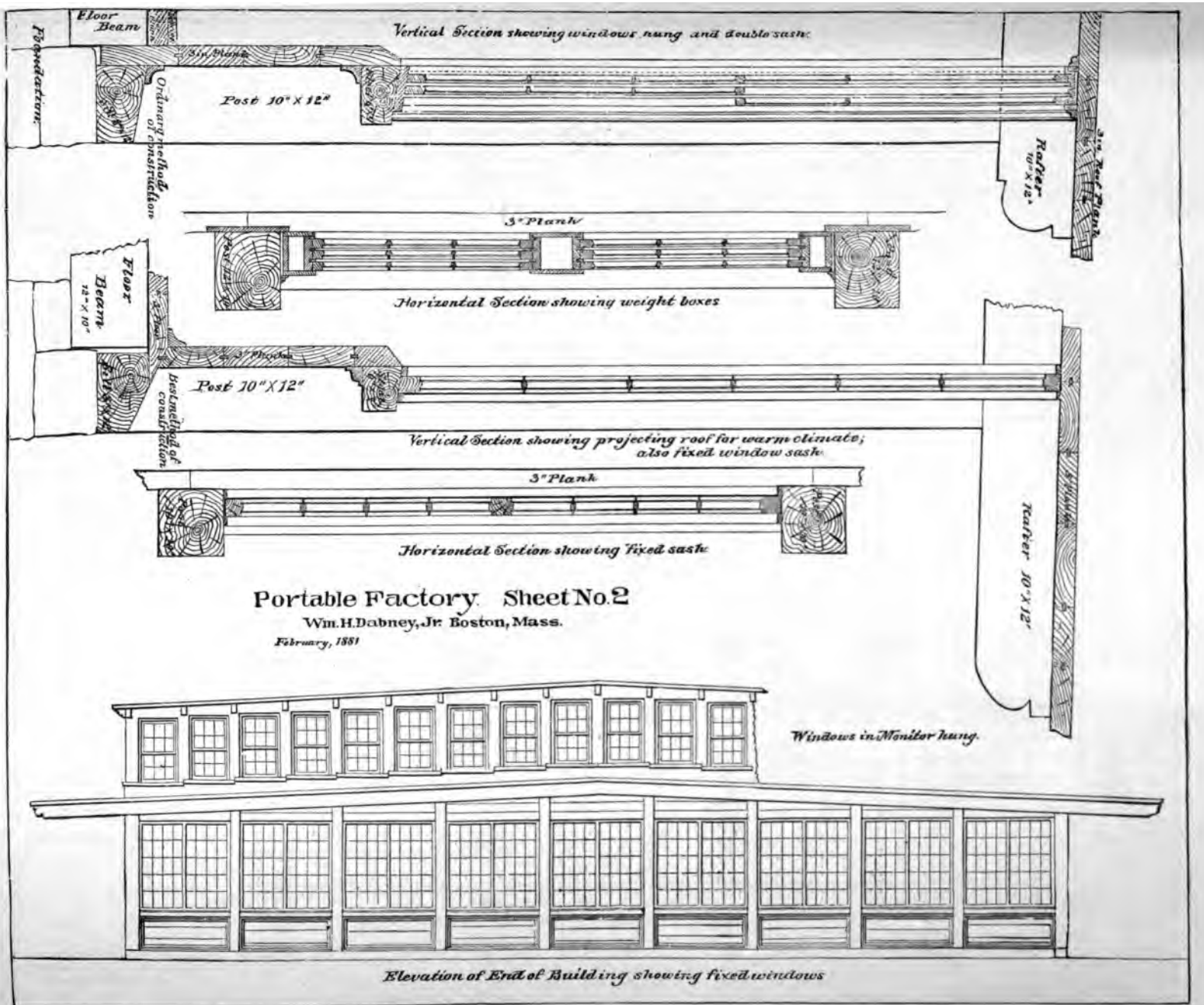
Respectfully submitted,

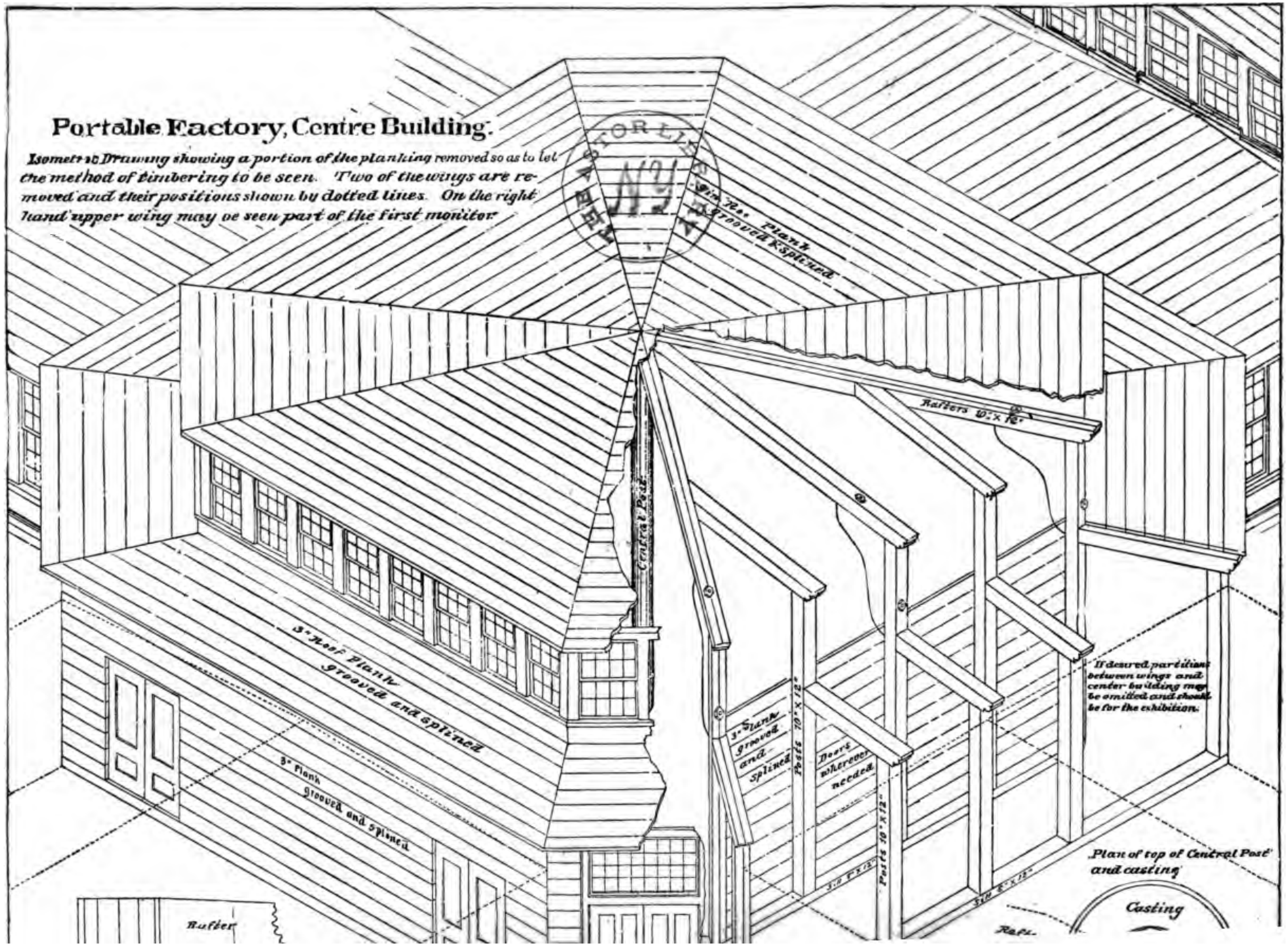
EDWARD ATKINSON.

Boston Manufacturers Mutual Fire Insurance Company,
Boston, Mass., February 14, 1881.




February, 1901.
William H. Dabney, Jr. Boston, Mass.
THE ASTOR LIBRARY
Section of Monitor
Rafter 10" X 18"
3 in Roof Plank
3in. Plank
Window Sill
3in Plank
Grooved and splined
Post 10" X 12"
Sill 8" X 12"
Section showing backmar tech pieces for stiffness
Floor Beam
Sill 12" X 8"
Plan
Horizontal section through window
Alternative Plan. The planks can be slipped in and will stay in place without nailing.


Floor Beam
Vertical Section showing windows hung and double sash
Sill Plank
Post 10" X 12"
Ordinary method of construction
Rafter 10" X 12"
3" Plank
Horizontal Section showing weight boxes
Floor Beam 12" X 10"
Best method of construction
Post 10" X 12"
Vertical Section showing projecting roof for warm climate; also fixed window sash
3" Plank
Rafter 10" X 12"
Horizontal Section showing fixed sash
Portable Factory. Sheet No. 2
Wm. H. Dabney, Jr. Boston, Mass.
February, 1881
Windows in Monitor hung.
Elevation of End of Building showing fixed windows



Portable Factory, Centre Building.

Isometric Drawing showing a portion of the planking removed so as to let the method of timbering to be seen. Two of the wings are removed and their positions shown by dotted lines. On the right hand upper wing may be seen part of the first monitor.

Note "A" from page 7.

From Special Report Boston Manufacturers' Mutual Insurance Co.:

OUTSIDE COVERINGS FOR FLAT ROOFS.

We are very often consulted as to what covering shall be placed upon the outside of a flat roof.

It often happens that those who have used tin desire to change to composition; those who have used composition desire to change to tin; others who have used both desire something else; and those who have never tried duck have not sufficient confidence in it to warrant an experiment.

The fault which has led to the distrust or dislike of the substance previously used is generally to be attributed to the bad construction of the roof proper. Either kind of covering laid over thin boards unmatched, or over unseasoned spruce plank of any thickness, is liable to be impaired from the shrinking or twisting of the material of the roof, or from the springing of the joist or timber, if the roof is not properly sustained. Felt, or composition coverings, or tin, will be sure to come into disrepute if false economy happens in their application, and materials of poor quality are made use of; this will always happen if owners make bargains with irresponsible contractors at prices at which the best materials cannot be afforded.

A frequent cause of injury to the outer roof covering is also to be found in the percolation of moisture through the cracks of the roof, which condenses upon the under side of the outer covering. This is the most frequent cause of the destruction of tin.

It has, therefore, become expedient for us to give the best rules which we can obtain for making tight roofs, and for securing durability in the outer covering.

The first requirement is that the timbers shall be of sufficient size to keep in place without serious deflection,—never exceeding twenty-five feet span, sustained either by a sufficient number of posts, or else by well-constructed trusses.

A truss can be made of timber to cover a mill seventy-two feet wide in the clear, at half inch rise to the foot. The next requirement is that the plank shall be never less than two inches thick, three inches very much preferred,—not only for stability, but for non-conduction of heat; plank to be grooved and splined, planed to uniform thickness, and thoroughly seasoned,—especially if owners will insist upon the false economy of making use of spruce plank, although pine is preferable at any reasonable difference in price.

A better inside finish can be secured at greater relative expense by the use of two-inch plank, sheathed underneath between the rafters crossway of the plank.

We do not advise any air space whatever in the substance of the roof, even though it may be so constructed as to be unobjectionable on account of fire.

An air space must be hermetically sealed to be of much value as a non-conducting medium. It is impossible to make an air space perfectly tight between two sections of wood. It therefore happens, when such a space is left in a roof, that the humidity of the mill or works passes through the sheathing into this air space, there condenses, and gradually rots both surfaces, the plank and the sheathing.

A solid, well-seasoned roof made of pine plank three inches thick, or of two-inch pine sheathed solid on the under side, will give stability, and will assure the greatest durability to whatever roof covering is put upon the outside.

Composition roofs covered with gravel placed over a properly constructed roof of timber and plank have, on the whole, proved to be the most satisfactory roof coverings.

The best instruction which can be given with respect to this kind of roofing is to employ no one who cannot be depended upon for thorough work.

COMPOSITION COVERINGS.

The right specifications are as follows:—

Place upon the roof plank three layers of roofing felt parallel with the eaves; continue by lapping each additional layer two-thirds of its width upon the preceding one; so continue until the whole sur-

face of the roof is covered. This being properly secured, coat the same with the melted co and over this place two additional layers of felt; secure this at intervals upon the surface, a eaves and about the chimneys, scuttles, monitors and battlement walls, in the manner h suggested.

The felt being thus properly secured, spread upon the surface a good body of the melte tion, and gravel in sufficient quantity to thoroughly incorporate the same with the compositi

The practice of cementing each sheet of felt as laid is not approved by the company done the largest amount of this kind of work.

No composition should be used until three sheets of the felt in thickness have been laid. lows greater freedom to the felt, which is not liable to become cemented to the plank, and is fore affected by the expansion or contraction of the same. The coating of composition be third and fourth layers of the felt increases its waterproof qualities and durability.

The following suggestions are made by the New England Felt Roofing Company, whic formed the largest part of this work:—

I. "The pitch of the roof should not be greater than one inch in the foot; a half inch if the roof is firmly constructed."

II. "Pine plank matched, two and a half to three inches in thickness, are most desirable ing; rafters from five to ten feet apart, according to the thickness of the planking, and of suf mensions to keep the roof firm."

III. "The carpenter and mason work should be completed, and chimneys topped out, hatchways, and monitors completed and finished, before the roofing is laid, when possible."

IV. "The strips or flashings for securing the felt at the eaves and walls, and about the bu generally, should not be placed in position until advised. Zinc or copper is preferable. mer has been found to answer the necessary requirements, and there is a great saving latter."

V. "Over dressing-rooms, dye-houses, and similar structures, provide for ample ventilati roof. This is rendered especially necessary from the fact that the roofing manufactured by t England Felt Roofing Co. is perfectly waterproof and air-tight, therefore no dampness from tion can be absorbed or pass through it."

COVERINGS OF TIN.

Use only the best M. F. Tern plate tin, with rosin-sized sheathing under the same. The ti be laid with white lead and secured with zinc. Tin will wear longer and is less liable to painted on the under side before laying. Two or three layers of tarred paper are sometime under the tin to serve as a cushion.

COVERINGS OF COTTON DUCK.

We have ventured to call attention to cotton duck properly laid as a covering for roofs wh desirable to make a saving in the weight of the roof covering, or for other reasons; and it h adopted by several of our most judicious members upon mills or auxiliary buildings.

Before making this suggestion for the covering of a roof on which it was desirable to dry investigated the durability of painted duck upon steamboat decks and upon the tops of railway we became fully satisfied that it would prove to be very durable, if properly prepared and laid

The longest record we have in respect to a roof covered at our own suggestion is four yea first experiment was made upon the roof of an auxiliary building attached to a woolen mill f since. It is now in fair condition, and has been more or less used for drying wool upon building was about 40 feet by 60 feet. The duck was stitched in one piece. The year after it down the plank had curled a little; the roof covering was detached, the plank planed off, an then attached again in its original position, but the unseasoned spruce plank continues to t curl and makes it difficult to keep the covering in good condition. No felt or sized paper wa under this covering. Wool is dried upon it throughout each summer season.

The next experiment was upon one-half of a new mill constructed by the Lawrence Duck Co., the other half being covered with composition. This covering has been examined year by year, and is now apparently as sound and in as good condition as when first laid.

The largest building yet covered with duck roofing at our suggestion is a mill belonging to the Merrick Thread Company.

Mr. Timothy Merrick has made use of this covering more than once, and permits me to give the following directions for placing the duck, to wit:—

"The chief danger to be guarded against in a canvas roof is from the condensation of moisture upon the under side. This must be provided for when the canvas is put down.

"Our latest method in placing a canvas roof last season combined all our previous experience, and was as follows: The roof plank were two-inch pine, of even width, planed to a uniform thickness, grooved and splined, fully seasoned, close laid with bearings five feet two inches on centres. Upon this was laid one thickness of rosin-sized heavy sheathing paper. This was covered with two layers of medium quality tarred roofing felt, with a mopping of composition between the two layers, sticking them firmly together. Over this, another layer of rosin-sized sheathing paper fastened at intervals to keep it in place until the canvas could be laid down. The object of this provision is to protect the canvas from the effect of the condensation of moisture from the room below, and to prevent the tarred paper from adhering to the canvas. We then used duck two yards wide, of weight equivalent to 13 oz. duck 22 inches wide, in cuts made to order of the length of the roof, nailed with ¾ inch copper nails; the laps of the canvas laid in paint at the time of nailing. We then saturated the duck with a coat of Wilmington tar, mixed with about 20% of linseed oil, put on warm so as to spread easily and penetrate the fibre of the duck fully. Finally, one or more coats of paint, as may be necessary for exterior protection."

It had been objected that the pine tar contains an acid liable to affect the duck in the course of time. In order to be certain upon this point the question has been put to Prof. J. M. Ordway, whose reply is as follows:—

"There is no acid in wood tar except acetic acid, and this has no weakening action on vegetable fibre.

"Wood tar contains a great deal of resin and some resin oils, and these will oxidize and change, but it will take a very long time. I can see no more objection to tarring duck than to tarring rope. Tarred rope is not quite so strong, theoretically, as simple rope; but that is merely because a foreign body separates the fibres a little from each other, and prevents them from responding at the same instant to a strain. Tar is much better to resist mildew than oil would be. Oil is a food for mold. There may be a little doubt as to the best way of applying oil. Oil paint over tar would be very slow in drying, and might remain sticky a long time. I believe tarred felt underneath would be sufficient without any impregnation of the canvas itself with tar. The tarred felt would soon give off vapor enough to the duck to prevent mildew. Felt or paper impregnated with coal tar should be used in preference to that made with Trinidad pitch."

We have submitted these various methods of covering roofs to meet questions frequently asked.

They give all the information which is within our knowledge.

With the decreasing price of copper, it may happen that copper will become available. It is, of course, the most durable material; but its high cost has heretofore prevented its general use upon factories.

Note "B" from page 7.

From Special Report Boston Manufacturers Mutual Insurance Company.

FIRE DOORS.

We find it necessary to repeat the warning against inadequate fire-doors, as we find thi is still placed on several classes of doors in which we have no confidence, such as rolled o doors, corrugated or hollow iron doors, wooden doors covered with zinc—a metal which melt 700 degrees Fahrenheit—wooden doors covered on only one side with tin.

The wooden door covered with tin only serves its purpose when the wood is fully enca put on in such a way that no air, or the minimum of air, can reach the wood when it is expo heat of a fire. Under these conditions, the surface of the wood is converted into charcoal; coal, being a non-conductor of heat, itself tends to retard the further combustion of the wo if air penetrates the tin casing in any measure, the charcoal first made, and then the wood both consumed, and the door is destroyed. In like manner, if a door is tinned only on on soon as the heat suffices to convert the surface of the wood under the tin and next to the fire coal, the oxygen reaches it from the outside, and the door is of little more value than a thi iron or a plain wooden door.

We submit the following specifications, drawn by Mr. W. B. Whiting, for making a fir shutter that will resist fire longer than any other door or shutter known to us, the constructio shutter varying from that of the door only in using thinner wood:

SPECIFICATIONS.

A door of the right construction to resist fire should be made of good pine, and should l or more thicknesses of matched boards nailed across each other, either at right angles or at degrees. If the doorway be more than seven feet by four feet, it would be better to use thr nesses of same stuff; in other words, the door should be of a thickness proportioned to its are a door should always be made to shut into a rabbet, or flush with the wall, when practicable; is a sliding door, then it should be made to shut into or behind a jamb, which would pr against the wall. The door and its jambs, if of wood, should then be sheathed with tin, tl being locked at joints and securely nailed under the locking with nails at least one inch long. spaces should be left in a door by panelling or otherwise, as the door will resist best that has solid material in it.

In most places, it is much better to fit the door upon inclined metal slides rather than upo

This kind of door may be fitted with automatic appliances, so that it will close of its subjected to the heat of a fire; but these appliances do not interfere with the ordinary methods ing and shutting the door. They only constitute a safeguard against negligence.

The best automatic appliance is that made by the Providence Steam & Gas Pipe Co. Th ing is their specification:

"The door is arranged to slide shut on an inclined track, and is kept open by a rod, whicl in two parts, united at the center with a brass sleeve which nicely fits the two ends of the ro sleeve is made in halves, which are secured together with fusible solder. The ends of the ro they come together are cut on an angle of forty-five degrees, and therefore tend to force the sle when the solder melts. One end of the rod is fastened to the door, and the other end to t frame."

This appliance may also be used upon swinging doors. Its cost is very small. We ther commend its adoption even on doors where there may seem to be but little need for such pr Had such doors been placed at each end of the bridge connecting the Picker Building and N of the Plymouth Cordage Co., the latter would probably have been saved.

Note "B" from page 7.

Western Manufacturers Mutual Insurance Company.

DETAILS OF AUTOMATIC FIRE DOORS, CUTS PAGES 39, 40 AND 41.

SLIDING DOOR.

Track of iron bolted to wall. Incline not less than 1 in 24 (½ inch to a foot).

a. "Grinnell Automatic Thrust Joint" in position.

ALTERNATIVE DEVICE.

Wire or cord permanently attached at C, connected with similar wire or cord by fusible link B, passing over pulley D to weight F and attached to hinged catch E.

Door catches at E when opened, but may be released and closed by lifting the latch. Fusible link B breaks at 160°, allowing weight F to drop, pulling down hinged catch E and releasing door, which at once closes of its own weight.

SWINGING DOOR.

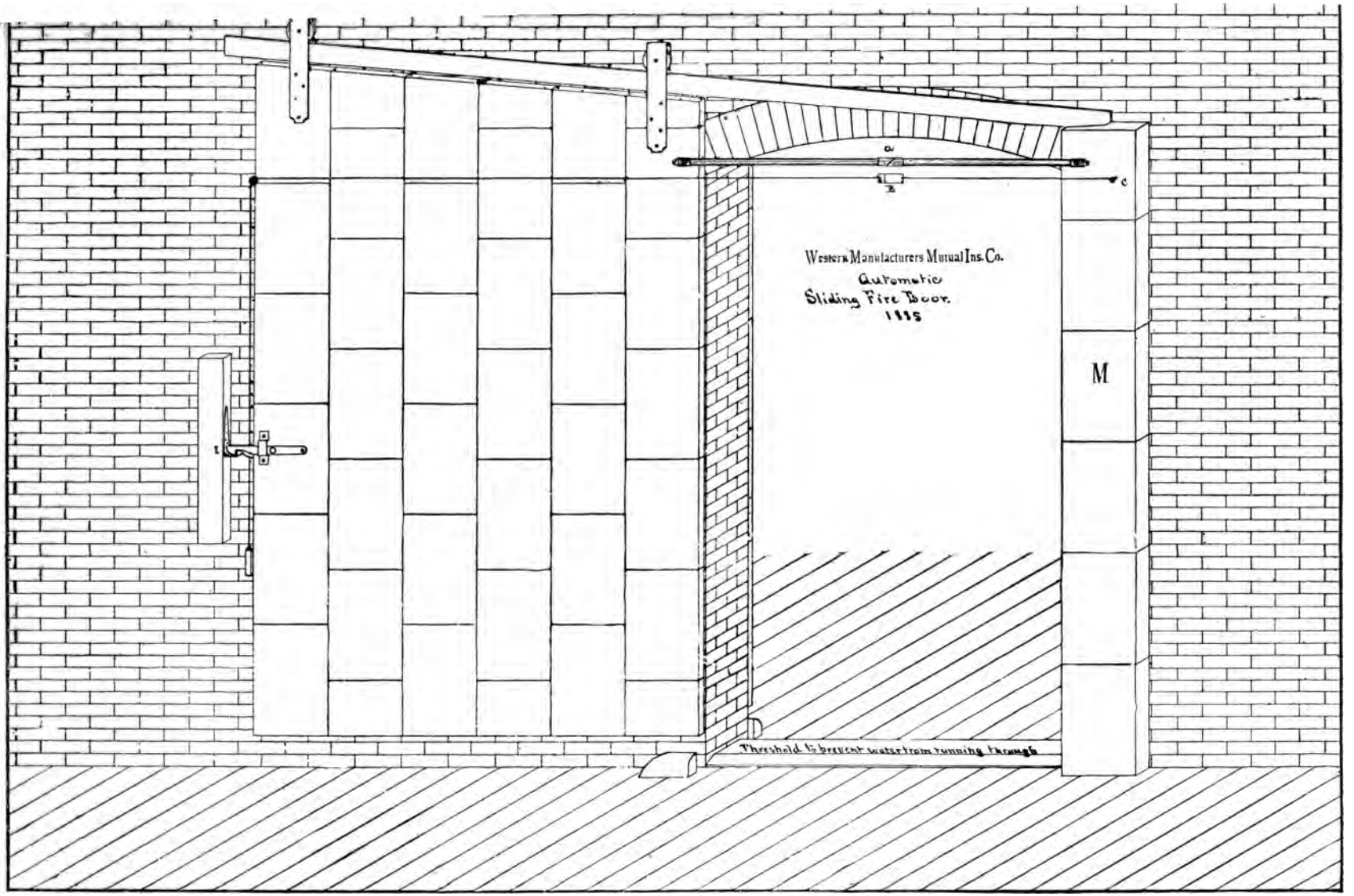
Mounted on spring hinges (those on working model and in use by some of our members are Union Manufacturing Company, New Britain, Conn., No. 1.)

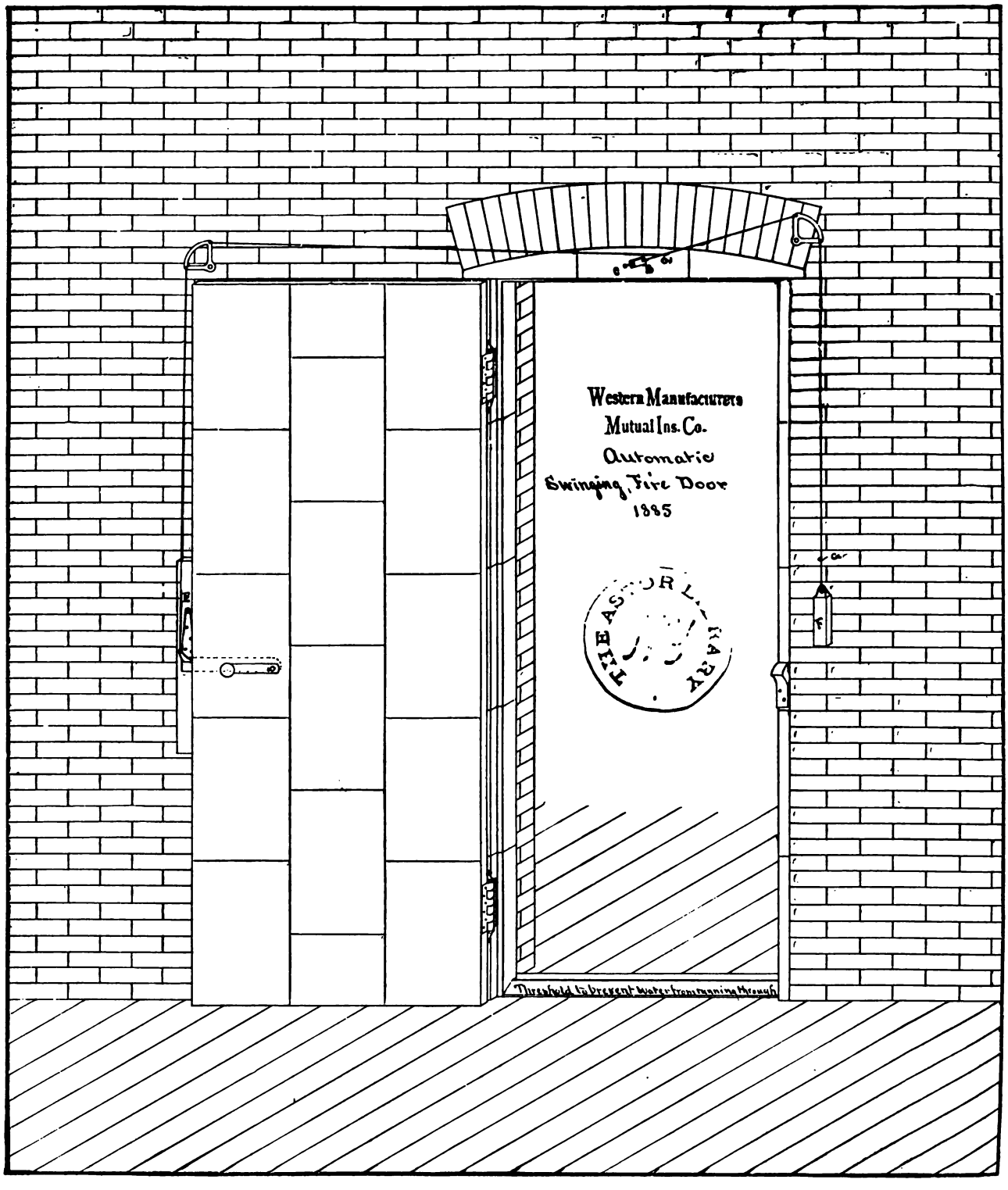
Wire permanently fastened at C and attached to fusible link B, which in turn is fastened by a mortise crank to weight F. This wire is united at A to another leading in a similar manner to hinged catch E, which is lifted when link breaks at 160°.

Dotted line shows latch which is on opposite side of door, which also fastens door when closed; G, a staple driven to prevent weight F swinging inward when released, boxing weight F being an alternative. It is important to make distance from B to A and B to C as short as practicable in order that parts of link B may not fall between door and casing and prevent closing. Link B should be as near top of doorway as it can be placed and not fall and prevent closing, as above stated. Fastening is best set out two or three inches from wall to allow free circulation of air about link B. This automatic apparatus can be varied by drilling a small hole diagonally through the brick behind the door and passing the wire through it, the fusible link in such case being placed near the center of the doorway about three inches below the top, and attached by a wire to staple in brick work, a pulley would then be used and same arrangement of catch and weight as in the sliding door, the door being released to close, while the appliance is intact by lifting the latch.

PARTS OF DOOR.

Figures 1 to 5 inclusive, give details of latch, which can be lifted on either side of door (Fig. 1, horizontal section) connecting bolt passes through door, working in an iron tube or sleeve. (Section through A, B, shows the connecting bolt and sleeve of ¾-inch gas pipe as long as door is thick; this latter should be loosely fitted to bolt, etc., so as not to turn when handles are moved.) Fig. 4 is latch plate. Fig. 5, catch to hold door closed. Fig. 6, section of catch to hold either door open; this can be made of strap hinge bent to form indicated. In that used for sliding door, the end should be bent to one side to prevent any interference between the wire and the latch. Fig. 7, latch to hold sliding door open. Fig. 8, section of casing M, cut of sliding door. Fig. 9, Grinnell Automatic Thrust Joint. Fig. 10, another mode of making handle for latch, being of ⅞ iron flattened at one end, and turned tapering with an offset.


Western Manufacturers Mutual Ins. Co.
Automatic
Sliding Fire Door.
1915
M
Threshold to prevent water from running through


Western Manufacturers
Mutual Ins. Co.
Automatic
Swinging Fire Door
1885
Threshold to prevent water from running through

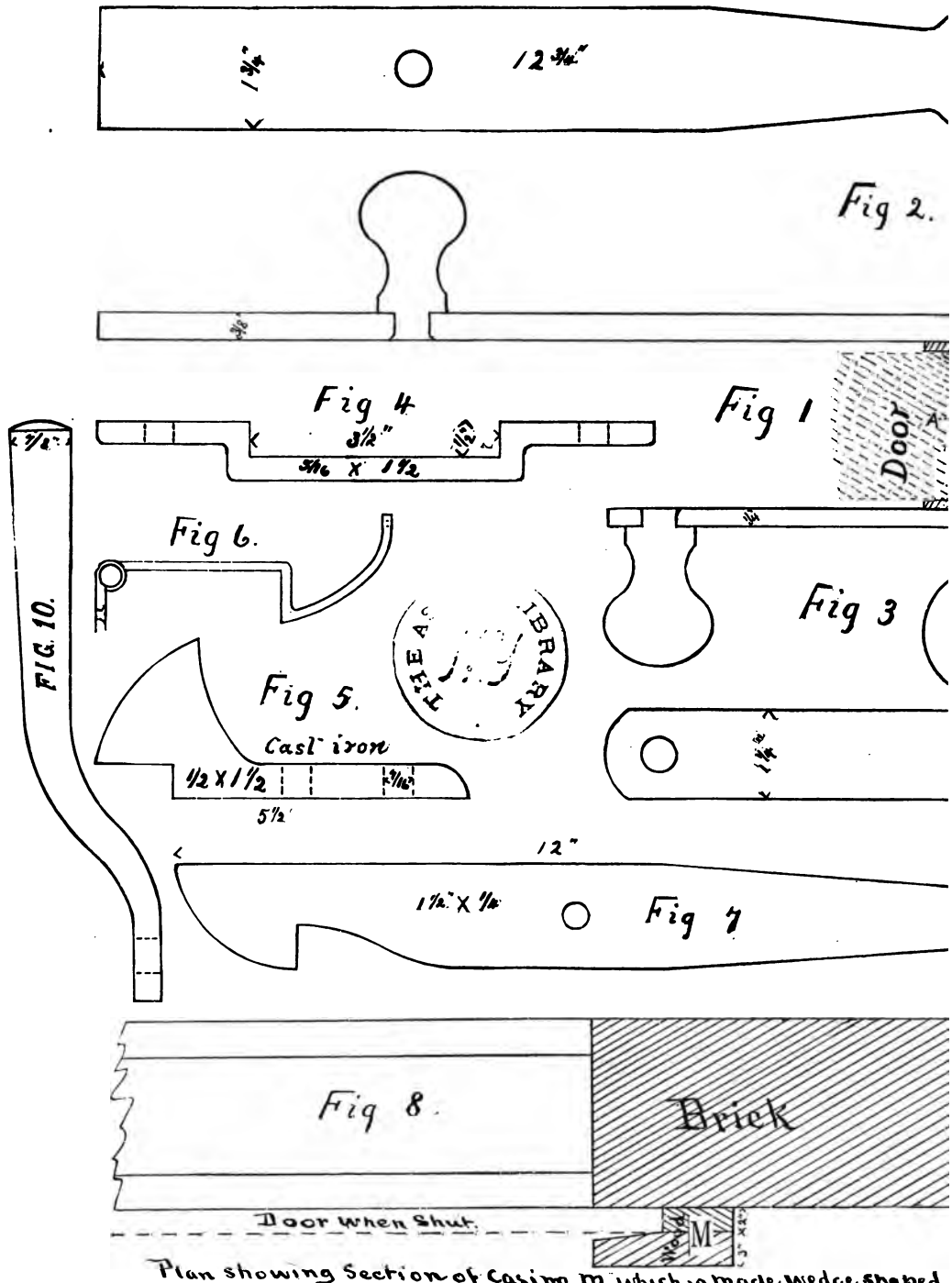


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Fig 9.

GRINNELL AUTOMATIC THRUST JOINT.

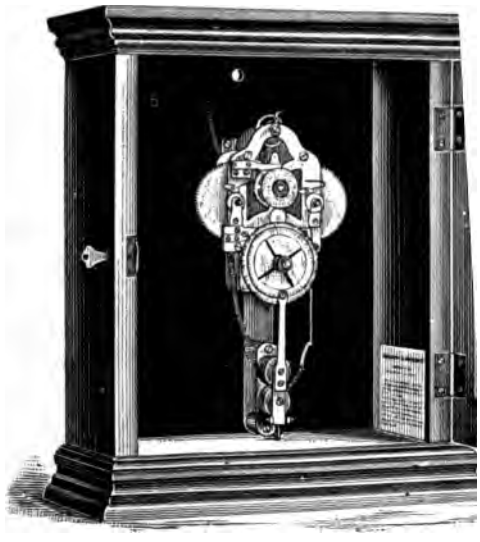
Patented May 15. 1883.

...connected with thin duplex system o
shown in this cut.

For flouring mills a thermostat especially prepared, ca
bolting chest connected with this system, so as not to give an a
by single target, placed on the beam overhead, designate at c
prompt attention.

Under this system an extraordinary heat cannot be produce
be given as above stated.

Our "Self-Register," which is shown in this cut, is a cloc



on which are placed figures corresponding to hours and minute
hile the larger revolves every twenty-four hours.

On the face of these dials are contact pins, and at any predet
e contact pins arriving upon the surface simultaneously, and a
it everything is in perfect working order.

On the closing of this circuit a puncture is made by a poin
er placed on the larger dial, thereby recording the fact tha
a right.

Note "A" from page 10.

THE RECORD OF SPRINKLERS.

There have been numerous experimental tests of automatic sprinklers, wherein they wer subjected to artificial conditions, whose value was measured by their approximation to th imposed by actual fires in buildings. It was by such experimental fires that the underwri public were first convinced of the value of this apparatus, but it is not my intention to all to such experiments, as the automatic sprinklers have been in use for a length of time suffi nish a record which will establish the facts in regard to the efficiency of their operation. upon property protected by sprinklers occurred early in 1877, and for several years their us solely confined to the protection of property insured in the Factory Mutual Insurance Compa England, and from the books of these companies I have compiled the records of fires and l period of eight years, from Jan. 1, 1877, to Jan. 1, 1885, dividing them into two lists, whether or not automatic sprinklers formed a portion of the apparatus.

Fires on property protected by automatic sprinklers and insured in the Boston Ma Mutual Fire Insurance Company:

Years.	Fires.	Claims.	Losses.
1877	4	None.	None.
1878	5	None.	None.
1879	4	1	$512 77
1880	6	2	1,192 72
1881	8	3	1,345 40
1882	19	5	1,567 97
1883	24	8	20,582 34
1884	33	12	8,976 81
Total	103	31	$34,178 01
Average loss per claim			$1,102 51
Average loss per fire			331 82

There have been, in addition to the above, thirty-two fires over automatic sprinklers insured only in other mutual insurance companies, and sixty similar fires on property where Factory Mutual Insurance Companies had any interest, making the whole record:

WHOLE RECORD OF AUTOMATIC SPRINKLER FIRES TO JAN. 1, 1885.

YEAR.	MUTUAL INSURANCE.		STOCK INSURANCE.	TOTAL.
	Boston Mfrs. Mutual.	Other Mutuals only.		
1877	4	None.	None.	4
1878	5	None.	None.	5
1879	4	None.	1	5
1880	6	3	3	12
1881	8	0	6	14
1882	19	6	5	30
1883	24	8	6	38
1884	33	15	39	87
Total	103	32	60	195

Average loss per fire, $327 20.

KIND OF SPRINKLERS.

YEAR.	Parmelee	Grinnell	Burritt	Bishop	Walworth	Brown	Conant	Harris	Ruthenburg
1877	3						1		
1878	5								
1879	5								
1880	12								
1881	14								
1882	15	7	3	3			1	1	
1883	8	20	7	2		1			
1884	24	51	6		2	2		1	1
Total	86	78	16	5	2	3	2	2	1

Which is practically identical with the average loss from such fires in the Boston Manufacturers' Mutual Fire Insurance Company only, as shown by the first table.

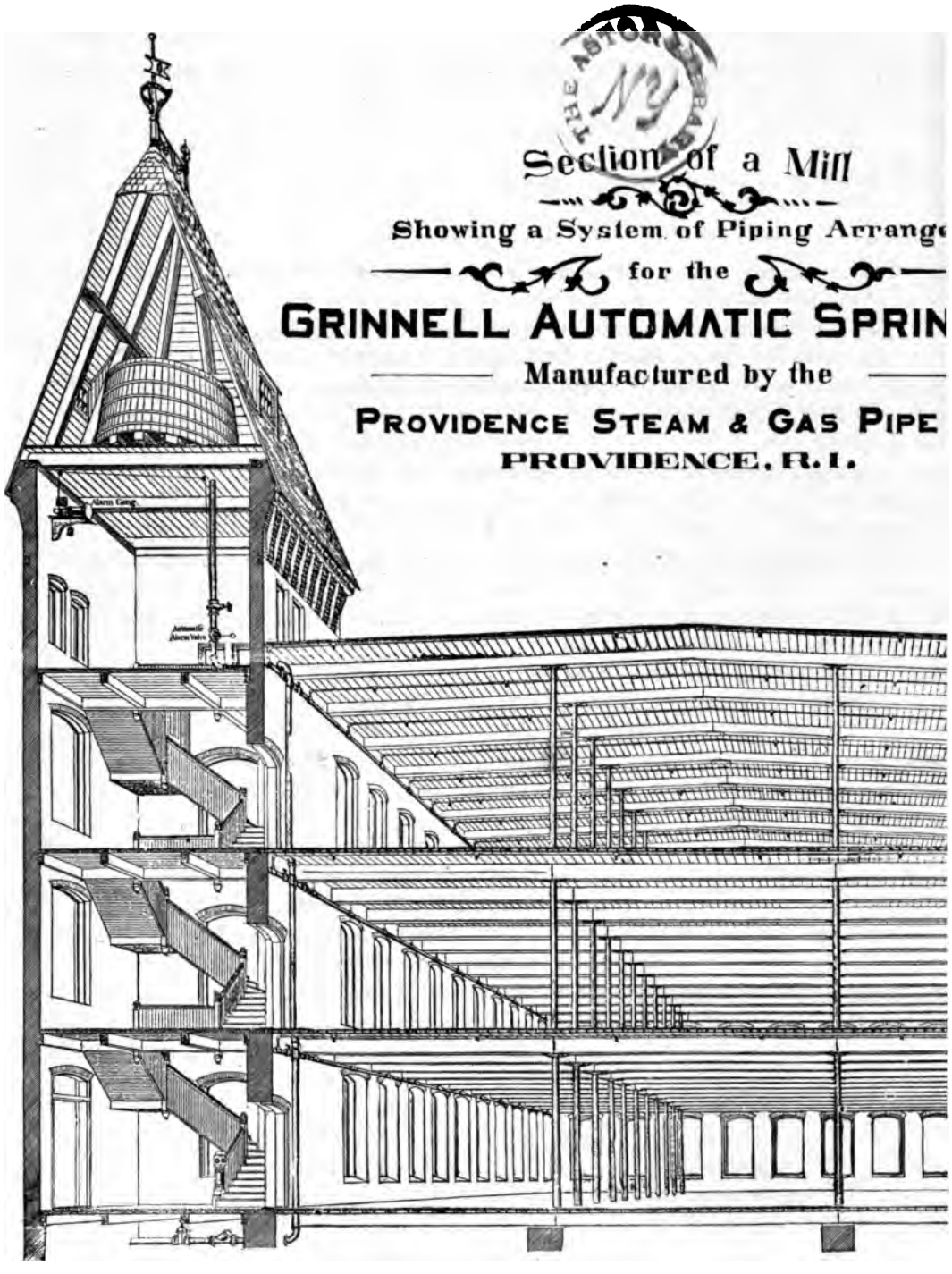
In comparison with the foregoing results the following table shows the experience of those fires upon property insured in the Boston Manufacturers' Mutual Fire Insurance Company, where automatic sprinklers did not form any portion of the protective apparatus:

FIRES ON PROPERTY NOT PROTECTED BY AUTOMATIC SPRINKLERS, AND INSURED IN THE BOSTON MANUFACTURERS' MUTUAL FIRE INSURANCE COMPANY.

Year.	Fires.	Claims.	Losses.
1877	44	32	$778,886 95
1878	62	26	233,535 26
1879	45	17	50,803 32
1880	80	30	775,008 36
1881	76	31	464,883 03
1882	120	32	866,873 93
1883	70	23	482,980 91
1884	56	36	657,136 29
Total	553	227	$4,310,108 05
Average loss per claim			$19,987 26
Average loss per fire			7,794 05

The following comparison of averages for the purpose of stating the measure of the benefits derived from the operation of automatic sprinklers, is based upon the whole number of fires, and not upon the whole number of claims, because it is a comparison of the efficiency of apparatus in the prevention of fire, and each system should have the credit of extinguishing any fires, be it done so promptly as to forestall the need for the services of the insurance adjusters. If the automatic sprinklers operate so much more promptly that the ratio of claims to losses is less, they are certainly entitled to credit for it. In the record of all fires cited in this connection, nearly thirty-nine per cent. are followed by claims, while of the automatic sprinkler fires alone, about thirty per cent. result in an appreciable loss.

Average of fires without sprinkler protection		$7,794 05
Average of fires with sprinkler protection		331 82
Difference		$7,462 23
Number of fires on property insured in the Factory Mutuals and protected by automatic sprinklers, 135		
Saving, at $7,462 23 per fire	$1,007,401 05	
Number of fires on property not insured in the Factory Mutuals and protected by automatic sprinklers, 60.		
Saving, at $7,462 23 per fire	447,733 80	
Estimate of total saving	$1,455,134 85	



Section of a Mill

Showing a System of Piping Arrange

for the

GRINNELL AUTOMATIC SPRIN

Manufactured by the

PROVIDENCE STEAM & GAS PIPE

PROVIDENCE, R. I.

This method of computation is against the work of automatic sprinklers because they were at first limited to the protection of the more hazardous portions and processes of mills, and it is quite recently that they have been placed over the whole of property, including those portions generally considered as being less liable to destruction by fire; and this estimate of a million and a half dollars as the measure of the saving caused by automatic sprinklers is clearly an understatement of the true amount. C. J. W. WOODBURY.

C. J. H. Woodbury's Lecture to the Society of Arts, Massachusetts Institute of Technology.

Note "B" from page 10.

From Special Report Boston Manufacturers Mutual Insurance Company.

BELT BOXES AND BELT ORIFICES.

In almost all mills recently constructed, the driving belts are carried in a separate chamber, cut off from the main rooms of the factory by fire walls; but a very large number of our older risks are exposed to the danger of fire being carried through belt boxes or belt openings, from one room to another; or, if the fire occurs in the engine-room, from there to all the rooms in the mill at the same time.

No destructive fire had ever originated in an engine-room until the loss of the Flint Mill. Since then we may attribute the loss of the Annisquam Mill to the same cause. In this latter case the engine was in the lower story of the mill.

We have urgently called attention to the need of keeping belt boxes clean, and we have also suggested a sufficient number of automatic sprinklers to be placed around the belts, in order to check a fire passing through the openings.

Objection having been taken to placing automatic sprinklers very near the main driving belts, lest they should be opened by accident and the belt be injured by water, we have suggested that the belts should be enclosed in a glazed chamber, and that the automatic sprinklers should be placed outside the glass.

We assumed that in such a case the heat would start the sprinkler outside the glass before it had been broken, and thus prevent the passage of fire, but that the glass would save the belt from damage by water in case a sprinkler head were opened by an accident.

During the present year the flax-mill of the A. H. Hart Co., of New York, had been insured upon condition that every room in the main mill should be fully protected with automatic sprinklers; for which purpose the owners selected the Walworth Manufacturing Company's sprinkler.

The engine-room was the lower room in a structure four stories in height, upon three sides of which were working departments of the factory. The belts were carried up in a section of this building which was separated from the rest by a partition, in which partition there were windows. In the part of the building devoted to the belts there was no working machinery; but the three upper floors were protected with sprinklers, the engine-room not then being thus protected.

On a Sunday evening a relief watchman entered the mill, took off his coat, and hung it up in what was assumed to be a fire-proof oil-room adjacent to the engine-room, with a lighted pipe in the pocket of the coat. This started a fire, which worked through the door, passed through the belt boxes, which were made nearly all of iron, and started four sprinklers in the room next above the engine-room, four in the next, two in the next, and one upon the other side of a window in the room adjacent to the belt chamber. The fire was wholly extinguished by the sprinklers in these rooms, and was stopped at the window. The belt was slightly injured, but the total damage did not suffice for the basis of a claim upon the underwriters. The engine-room has since been protected with automatics.

It would therefore appear that our suggestions have been fully justified, including the suggestion to place sprinklers outside of a glazed partition to prevent the fire passing from a glazed belt chamber to the working departments of a factory.

We trust that this statement will lead every member to give especial attention to this matter; and we urgently advise every member whose mill is now protected only in all the departments in which the

The cost of oil and grease for lubrication in the first period, was	$103,162 35
or - - - - - $10.03 to each 10,000 lbs. cloth.	
In the second period - - - - - - - - -	73,482 71
or - - - - - $6.67 to each 10,000 lbs. cloth.	
Decrease in the cost of lubrication, 33 per cent.	
If the cost of lubrication had been $10.03 for each 10,000 lbs. in 1880	
the gross sum would have been - - - - - -	$110,497 19
The actual cost was - - - - - - - -	73,482 71
Difference for $8\frac{1}{12}$ months - - - - -	$37,014 48
or, for 12 months, in round figures - - - - -	55,000 00

The above 78 mills represent an annual consumption of 400,000 bales cotton, which constitutes about thirty per cent. of the consumption of the cotton factories that are insured in this or in other mutual companies. If the decrease of cost in these mills represents an average of the whole, the lubrication of machinery in cotton mills insured by us costs $180,000 less annually than it did at the time this investigation was entered upon. The change has been computed first on 53, then on 65, and last on 78 mills, with substantially uniform results. We may therefore infer a general rule.

Of course we cannot claim all this saving as the direct result of our work, because there has been a great decline in the prices of oils, ranging from ten to forty per cent., except so far as that reduction may be attributed to this investigation. One of the largest dealers, to whom these figures have been submitted, attributes two-fifths to the reduction of price, and the remainder to the saving of waste and to the more general use of a uniform quality of fine mineral or so-called paraffine oil, at a substantially uniform range of prices, in place of a considerable use of mixed oils under fancy names, and at all sorts of prices. In comparing particular cases, we find this view confirmed; but, if we may not assume so much of the savings as would amount to three-fifths, or $100,000 a year, yet we may fairly claim, as the direct result of changes made in consequence of this investigation, a sum equal to all the losses and expenses of this Company for the two years that have elapsed since our work began to have an influence,—especially an influence upon the manufacture of oil.

Another result of this work has been the invention of the machine on which we can now ascertain the anti-frictional properties of any oil with absolute certainty, and by the use of which we have obtained measurements of the coëfficient of friction with an accuracy and uniformity that have never been approached before. The results of Mr. Woodbury's experiments, presented by him at the recent meeting of the American Association for the Advancement of Science, have been accepted as a long step in advance of anything ever attained before.

One issue of these experiments may perhaps be to settle some points in respect to the power required or power saved by the use of the different kinds of spindles and bobbins now in use. Our machine having been adjusted in velocity and other conditions to those of a Sawyer spindle operating at 7,600 turns per minute, under a band tension of four pounds, it appeared that the difference in power required to overcome the resistance of the parts varied as follows:—

The resistance or power required to operate the frictional machine at 100° F., when lubricated with Downer Oil Co. 32° extra machinery oil, amounted to 756; and under the same conditions, with the exception of the substitution of neatsfoot oil as a lubricant, the resistance amounted to 2,427, or three and twenty-one hundredths times as much.

In respect to the same oil at different degrees of temperature in the bearing, the resistance at 50° is about 75 per cent. in excess of that at 75° F.

In respect to the best oil and the poorest lubricant at 100° F., the difference is 321 per cent.

In respect to a difference of pressure varying from 1 lb. to 5 lbs., the difference is 229 per cent.

By means of experiments applied to a small Sawyer spindle-frame, which could not be reduced to such precise accuracy, but which marked the great variations in power, according to the greater or less tension of the bands, other results were reached of the same general character, fully confirming the above conclusions.

The general conclusions reached are, therefore, that although as a matter of course there must be a marked difference in power needed between a well planned and constructed and a badly planned and

constructed spinning-frame, yet, when it is a question between two well-constructed frames only in the weight of the spindles within the ordinary limits of modern practice, or in the leng spindles and the position of the bearings, or in the solid or open construction of the bobbin, presence or absence of a chamber at the top of the bobbin, —the greatest differences in these not make as much difference in the power required as may be made in the adjustment and t the bands, or in the quality and condition of the oil; and hardly as much as may be made by in the temperature and condition of the atmosphere and of the machine, or in the quality and of the stock in use. The uniform tension of the band appears to be the factor of the greatest im and the structure of the bobbin of the least, provided the spindle is long enough and hea enough to keep the bobbin true, and to prevent it from springing under the varying conditic atmosphere.

In respect to the best quality of oil to be used on spindles,—that is to say, the best oil t on light bearings at very high velocity,—a few simple rules may now be laid down dogmatical as rules are to be made by experiments on a single machine, or from laboratory experiments:—

1. A mineral oil that flashes at less than 300° F. does not possess the best qualities for lul and is unsafe in proportion to the lesser degree at which it flashes.

2. A mineral oil that evaporates more than five per cent. in ten hours, at a heat of 14 hazardous in proportion to the increased percentage of volatile matter, and is also more unfit t as a lubricant the more rapidly it evaporates; because the the remainder will either become t viscous, requiring a high heat in the bearing to make it operate at all, or else, if the oil contain such a residuum liable to become thick and heavy, it will leave the bearing dry.

3. All the mineral oils—and also sperm, lard, and neatsfoot oils—appear to reach a nearly coëfficient of friction at very greatly different degrees of heat in the bearings. Several kin best mineral oils, and sperm and lard oils, show a uniform coëfficient of friction at the t degrees of heat:—

Temperature at which the Coefficient of Friction is the same.

Downer Oil Co. 32° Machinery (an exceedingly fluid of oil)	76
" " Light Spindle	105
" " Heavy Spindle	125
Various samples of Sperms	96 to 114
Leonard & Ellis Valvoline Spindle	127
" " White Valvoline Spindle	122
" " White Loom	111
Olney Bros. German Spindle	112
" " A Spindle	107
Neatsfoot	170
Lard Oil	180

4. Lubrication seems to be effective in adverse ratio to viscosity,—*i. e.*, the most fluid will stay in its place is the best to use. Lard oil heated to 130° lubricates as well as Sperm a the best mineral oil at 50°. But of course it is a great waste of machinery to work oil of any to an excessive heat; and there must be the least wear in the use of oil that shows the least c of friction at the lowest degree of heat.

5. The quantity of oil used is a matter of much less importance than the quality. The saves gallons of oil at the cost of tons of coal, or dollars of repairs, plays a losing game. Mr. experiments on very heavy bearings at Manchester go far to prove that a considerable quantity fine oil keeps the bearing much cooler, and requires less power, than a smaller quantity of thicl oil. Here let it be observed, that a superstition that prevails, in favor of using castor oil to c bearing, is without any warrant. No vegetable oil is fit to use as a lubricant; and castor o worst of all, because the most viscous. If used, it will surely set the mill on fire, as it did in case of which we have a record.

6. The rule of best lubrication is to use an oil that has the greatest adhesiveness to metal surfaces, and the least adherence as to its own particles. Fine mineral oils stand first in this respect, sperm second, neatsfoot third, lard fourth.

7. Cast iron holds oil better than any other metal or any alloy, and is the best metal to use for light bearings, perhaps for heavy.

8. It has been proved by Mr. Waite's experiments that a highly polished bearing is more liable to friction than a surface finely lined by filing. The lines left by the file serve as reservoirs for the oil, while the high polish leaves no room for the particles between the metal surfaces.

So far as laboratory experiments may serve as a guide in practice, it therefore appears that fine mineral oils may be made to serve all the purposes of a cotton mill, and such is the practice in some of the mills that show the very best results in point of economy;

Next, that the best animal oil to mix with a fine mineral oil, in order to give it more body, is sperm oil; this, again, accords with the practice of many of the mills in which the greatest economy is attained.

Lard and neatsfoot oil are used to give body to mineral oil in some of the best mills; but the results of our work seem *not* to warrant this practice, unless there is some peculiarity in the machinery that makes it more difficult to keep a less viscous or tenacious oil on the bearings.

All the mixed oils sold under fancy names we believe must of necessity consist of certain proportions of the oils heretofore named, as none of the vegetable or fish oils are fit to be used, and there are no other animal oils that can be had in quantity.

It appears that all varieties of mineral oil are or have been used in print-cloth mills, and are all removed in the process of bleaching, as practised in print-works.

All mineral oils stain more or less, and give more or less difficulty to the bleacher when dropped upon thick cloth, or cloth of a close texture. On this point we have been able to establish no positive rule; but, as very many kinds are and have been used in mills working on such cloths and are removed, we are inclined to the belief that this question is not of as great importance as it has been assumed to be.

Note "A" from page 14.

FIRE DEPARTMENT.

In the judgment of the great majority of the managers of the mills and the members of this company, there is no method of preventing loss by fire so necessary as the organization of an adequate fire department on the premises. We have, from time to time, called attention to this necessity during the last year and a half, and with very few exceptions our suggestions have been adopted.

As the large majority of our members would consider us delinquent if we did not press this point by every means in our power, we are now obliged to take the ground that the want of such a fire department can only be offset by an additional rate of premium on the premises.

We do not suggest any cumbrous or costly service, and do not ask more than every manager can grant without expense.

Herewith is a form which gives the general idea of what is considered an adequate fire department.

EDWARD ATKINSON, President.

Boston, June 7, 1879.

Note "B" from page 14.

From Special Report Boston Manufacturers Mutual Insurance Company.

Inquiries are frequently made from the smaller manufacturing establishments for an outline or plan of what can best be done in such concerns in the way of organization of a fire department in yards where few men are employed, and where the overseers of the rooms constitute almost wholly the intelligent element. To meet such cases we submit the following:—

To render the service more prompt and efficient in case of fire, it is recommended tl in the employ of the mills, on whom the company rely to protect their property, be orga fire company under proper officers, and that each man be assigned to a particular duty an that each man shall always be found in the proper place; let it be his duty immediately, of an alarm of fire, to go at once to his appointed position, and await orders. We recom thing like the following.

Foreman or Chief, THE AGENT.

1st Assistant Foreman.

2d Assistant Foreman.

To stop and start Engine and Wheels,

Assistant or Assistants.

To put pumps in gear and stay by them,

Assistant.

Foreman of Hose.

Assistant Foreman.

Leading Hoseman,

"

"

"

"

"

"

Placing the names of the best men for these places opposite the headings, give organization.

Now for the mode of working. At your regular times for trials of apparatus, say or fourth Saturday in each of the warm months, let the clerk of your company notify a n let the men assemble in the yard at the hour designated. You will say, "There is Repair Shop," or at any other point you please. If the wheels are running, the wheel-n any further orders, shuts down at once; the pump-men put their pumps in gear, and the leading hose directs his men where and how much hose to hitch on, and as soon as he word is passed to the wheel-man and the pumps are started. This, after the original ord by you, leaves the men to do as their own judgment prompts them; and if they do it w the water on the designated point without delay and without mistakes, it will make the dence in themselves, and render them cool in case of actual fire; and if mistakes are ma remember them, and avoid the like next time. Let this plan or a like one be adopted at ing, and your men will get the habit of doing their work easily and rapidly; then, wh you are present when a fire occurs, you will not have to bawl and halloo to a crazy crow hard and do nothing; and if you are absent you will feel that all will be done well if an Of course the whole thing is this: In case of fire get the water on as quickly as possibl no mistakes.

It is of the utmost importance that the watchmen, who may often constitute the wl the premises, should be specially drilled in the use of the apparatus, and instructed what t of fire.

Note "C" from page 14.

From Special Report Boston Manufacturers Mutual Insurance Co.:

We next give the instructions under which a system of inspection has been in operation, for many years, in one of our largest metal-working risks.

INSTRUCTIONS FOR INSPECTION OF FIRE APPARATUS.

Each inspection is to cover the entire premises of the Company.

1. The Inspector will examine every hose connection, move every hose valve or cork, and see that the hose is properly connected and readily accessible for use. Also see that every fire bucket is filled with water, and that each fire lantern is filled, trimmed and ready for use.

2. The Inspector will carefully examine the surroundings of every steam boiler, stove and heater, to see that no inflammable materials are near them; that all smoke and flue connections are tight, stove pipes well secured, and everything safe.

3. The Inspector will carefully follow the line of every steam-pipe throughout its whole length, to see that it is not in contact with wood, and that no waste or other inflammable materials are near it. In summer this need apply only to such pipes as are then in use. In winter ALL steam-pipes must be so inspected. Any leaks in pipes or valves are to be immediately reported to the Superintendent.

4. The Inspector will carefully examine spaces beneath all work-benches and tables, and will remove therefrom any inflammable materials he may find. All cases of carelessness which he may note in this inspection to be promptly reported.

5. The Inspector will particularly examine all places where oil, varnish, alcohol, lacquer, japan, etc., are stored, to see that every precaution is taken against fire. He will also inspect every receptacle for dirty waste, to see that it is in proper order and place.

6. The Inspector will note the condition of the yards, and see that no accumulation of inflammable materials occurs near any of the buildings.

7. Once monthly the Inspector will carefully examine every chimney used for fires to see that its joints are tight, particularly near the roof or other wood work, and that no inflammable dirt is collected near it.

8. Once each month the Inspector will take down and uncoil every fire hose, leaving it extended over night, and replacing it properly the next day. In doing this he will note the condition of the hose, and see particularly that it is not becoming cracked or injured by the method of hanging or otherwise. All defects in hose to be promptly reported to the Superintendent.

REPORT.

To the General Superintendent:

I have to report that on.....I made a thorough inspection, in accordance with the above instructions.

I found the instructions numbered.....to have been properly complied with, and everything in the place and condition designated.

I found violations of the instructions numbered .....

I report the following matters as needing attention, viz.:.....

.....

.....

I make the following suggestions for the better protection of the property, viz.:

.....

.....

.....

Inspector.

Note "D" from page 14.

Example of inspection report as used:

LEWISTON BLEACHERY AND DYE WORKS.

INSPECTORS' WEEKLY REPORT.

The undersigned report the result of their examination of the different departments

DEPARTMENTS.	Casks and Pails.	Rags and Dirt-Boxes.	Hydrants.	Hose and Fittings.	Closets and Benches.	Fire-Doors.	Dirt around Steam-Pipes.	Gas and Water-Pipes.	Pumps tried or turned.	Steam-Pipes.	Elevator Machinery.	Elevator Hatches.	Safety Lamps for Lighting Gas.
Colored Finishing Room	o	o	o	o	o	o	o	o	o	o	o	o	o
White Finishing Room	o	o	o	o	o	o	o	o	o	o	o	o	x
Calender Room No. 1	o	o	o	o	o	x	o	o	o	o			o
Calender Room No. 2	o	o			o		o	o		o			
Can Room No. 1	o	o			o	o	o	o		o		o	x
Can Room No. 2	o	o			o	x	o	o		o			
Can Room No. 3	o	o			o	o	o	o		x		x	
Winding Room		o			o		o	o		o			
Grey Room	o	o	o	x	o	o	o	o	o	o			x
Box Shop	o		o	o	o	o	o	o	o	o			o
Kier Room					o					o			o
Bleach Room					o			o		o			o
Starch Room			o		o		o	o		o	x		x
Dye House No. 1			o		o		o	o	o	o			o
Dye House No. 2					o		o	o		o			
Logwood Shed							o	o		o			
Wheel-Houses					o		o	o	o	o			
Machine Shop					o		o	o		o			o
Carpenter Shop	o				o		o	o		o			o
Dry Sheds												o	
Boiler Rooms					o		o	o	o	o			
Store-House			o			o							

We would again call attention to boxes used in Colored Finishing Room as being a collecting inflammable material. Would suggest that a metallic box of some kind be u Room to hold oil-cans, coal-tar, and lead mixtures; also, that a *pan* be used for holding oil- Shop. We would also suggest for consideration the closing of fire-doors in store-house au

JOHN WINN,
C. J. MULLANEY, } *I*

LEWISTON, Jan. 17, 1885.

Note E from page 14.

FORM OF

INSPECTORS' WEEKLY REPORT.

The undersigned report the result of their examination of the mills as follows:

BUILDINGS.	Casks and Pails.	Waste and W. Boxes.	Steam Pipes.	Hydrants.	Hose and Fittings.	Closets and Benches.	Fire Doors.	Dirt around Steam Pipes.	Gas and Water Pipes.	Lanterns.	Pumps tried or turned.	Elevator Hatches.	Unclean Machinery	General Order.			
;st Div. Cotton																	
ıdle " "																	
st " "																	
r. A. Picker																	
B. Waste																	
C. Boiler																	
D. Repair																	
E. Dye																	
;king and Office																	
r. A. Print Works																	
B. " "																	
C. " "																	
D. " "																	
E. " "																	
rehouse																	

REMARKS.

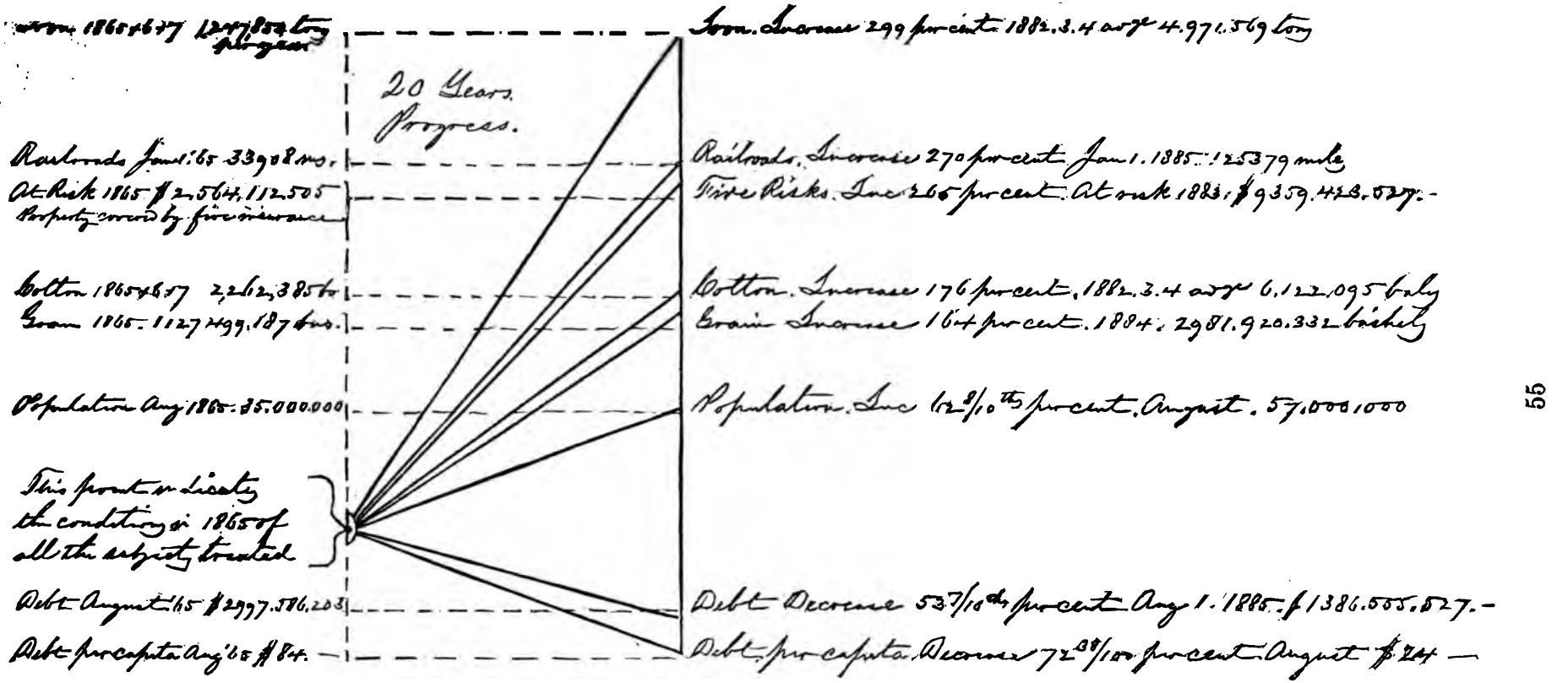
[NOTE.—As an alternative for the first column (Buildings), we suggest "Departments." For instance, card-m, spinning do., weaving do., and have report apply more directly to rooms.

This method would deal personally with rooms, but would necessitate the use of more sheets.

With the above form, a fault in the weaving-room of West Div. would show a x in that line in the check-list, explained at length under "Remarks."]

;ned,

Inspectors.



The increase in the amount covered by policies of insurance against fire as based upon tables compiled by H. H. Howe Esq. Editor of the Insurance Monitor. It gives some indication of the increase in realized wealth but is probably not quite a fair criterion owing to the condition in the South at that date. In 1870 the amount insured was $4035.907.596.- The Debt statement for 1865 covers both the liquidated and unsettled debt as computed by Hon. Hugh McCulloch Secty The 20 crops of cotton since the war exceed the 20 crops preceding the war by over 30 000 000 bales

Compiled by Edward Atkinson August 1885

From Special Report Boston Manufacturers Mutual Insurance Company.

ELECTRO-MOTIVE POWER.

Nearly one-quarter part of our risks being now furnished with dynamo-electric machines for purposes of lighting, the following statement of the special use to which the electric lighting plant has been put in the Pemberton Company may be of interest.

By calling attention to this application of electricity as a motive power, we do not intend to indorse or approve it until it has been under supervision for a sufficient period to determine all the conditions. We merely call attention to this instance, as the second application among our members of an electric lighting plant to other purposes, to which our attention has been called. In the first instance the application was made about two years ago and has been continued ever since. In this case a Daft motor was made use of. If successful and safe, there may be many other ways in which such application may be made, which will be greatly to the benefit of underwriters.

There is often a good deal of work in a mill-yard for which it would be very convenient to have a small portable steam-engine. It may perhaps be possible to mount a small electro-motor on wheels so as to make it easily portable; to anchor it where needed, and to operate it with a wire from the dynamo machine.

For many purposes, especially for night repair work requiring special power, such apparatus might be very desirable, since power and a safe incandescent light might be furnished from the same wire at the same time.

The six-horse power dynamo in use in the Pemberton Store-house weighs between 1,100 and 1,200 pounds.

A two-horse power motor could be easily carried by two men, and anchored wherever needed. It may be suggested that special machine shop tools could be operated on repair work at night in a much safer way than to run full lines of shafting from the wheel or engine. Perhaps calico-printing machines may be operated in this way, and even special departments of mills in which extra work is required to meet emergencies, if the shafting is so adjusted that the lines especially needed can be cut off from the rest.

LAWRENCE, MASS., November 12, 1884.

EDWARD ATKINSON, ESQ., *President:*

Dear Sir:—The Pemberton Company have just finished putting an elevator into their store-house on the corner of Canal and Union Streets. The elevator is one of the latest-improved, with self-closing hatches, and of sufficient size to carry six bales of cotton. The power for driving this is by means of a six-horse power Sprague electric motor,—one of the identical machines shown and operated in the late electrical exhibition at Philadelphia. The electricity for propelling the motor is furnished through two wires from our Edison dynamos situated in the mill about one thousand feet away from the motor. As we only use the elevator in day-light, having nor using any artificial lights in the store-house, the dynamos, which supply 450 lamps in the mill when needed, have always by day sufficient surplus to supply the motor at the store-house.

Yours truly,

F. E. CLARKE, *Agent.*


form 410